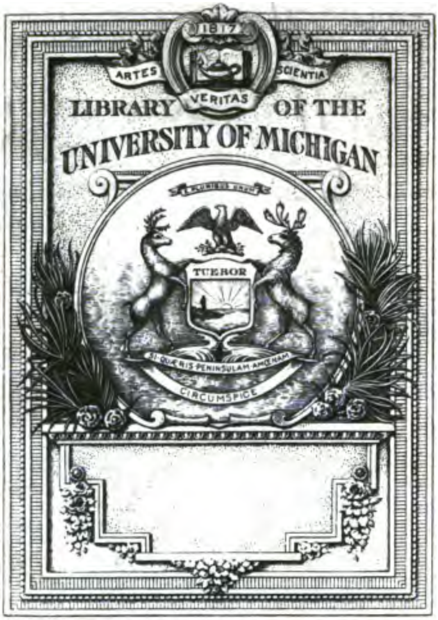

1817
ARTES
VERITAS
SCIENTIA
LIBRARY OF THE
UNIVERSITY OF MICHIGAN
TUEBOR
SI QUÆRIS PENINSULAM AMŒNAM
CIRCUMSPICE

THE

SCHOLAR'S GUIDE

TO

ARITHMETIC.

BEING A COLLECTION OF THE

MOST USEFUL RULES,

VIZ.

NOTATION, ADDITION, SUBTRACTION, MULTIPLICATION, DIVISION, REDUCTION, RULE OF THREE, PRACTICE, INTEREST, BARTER, LOSS AND GAIN, TARE AND TRETT, FELLOWSHIP, ALLIGATION, DOUBLE RULE OF THREE, VULGAR FRACTIONS, DECIMAL FRACTIONS, INTEREST BY DECIMALS, EXTRACTION OF THE SQUARE AND CUBE ROOT, POSITION, PROGRESSION, DUODECIMALS OR CROSS MULTIPLICATION:

TO WHICH IS ADDED,

A SHORT TREATISE ON MENSURATION

OF

PLANES AND SOLIDS;

WITH A SUFFICIENT NUMBER OF PRACTICAL QUESTIONS AT THE END OF EACH RULE.

Designed for the use of Schools.

BY PHINEHAS MERRILL.

THIRD DOVER EDITION,

REVISED, CORRECTED, AND IMPROVED.

DOVER, (N. H.):

PUBLISHED BY JESSE VARNEY, (PROPRIETOR), AND SOLD BY HIM AT HIS STORE IN DOVER; ALSO, BY HARRISON GRAY, PORTSMOUTH; AND BY THE PRINCIPAL BOOKSELLERS IN THE NEW-ENGLAND STATES.

1819.

J. J. WILLIAMS, PRINTER, EXETER.

District of New-Hampshire, to wit:

Be it remembered, that on the sixteenth day of January, in the forty-third year of the Independence of the United States of America, JESSE VARNEY of the said District, hath deposited in this office the title of a book, the right whereof he claims as proprietor in the words following, *to wit*:—"The Scholar's Guide to Arithmetic. Being a collection of the most useful rules, viz. "Notation, Addition, Subtraction, Multiplication, Division, Reduction, Rule of "Three, Practice, Interest, Barter, Loss and Gain, Tare and Trett, Fellowship, Alligation, Double Rule of Three, Vulgar Fractions, Decimal Fractions, Interest by Decimals, Extraction of the Square and Cube Root, Position, Progression, Duodecimals, or Cross Multiplication: To which is added "a short treatise on Mensuration of Planes and Solids: with a sufficient number of practical questions at the end of each rule. Designed for the use of "Schools.—By PHINEHAS MERRILL. Third Dover Edition, Revised, Corrected, and Improved."—In conformity to the Act of the Congress of the United States, entitled, "An Act for the encouragement of learning, by securing the copies of Maps, Charts, and Books to the Authors and Proprietors of such copies, during the times therein mentioned."

PEYTON R. FREEMAN,
Clerk of the District of New-Hampshire.
A true Copy of Record, Attest,
PEYTON R. FREEMAN, *Clerk.*

Hist. of Sci.
Rull
11-6-36
33124

PREFACE.

WHEN I first entered the business of teaching a School, I found it necessary to use a printed book for teaching Arithmetic, for which purpose I made choice of DILWORTH'S—but this not answering my expectation, I introduced several other authors on that science. But my school being often crowded, I had not time either to write, or to see to the writing of such Rules and Questions as were necessary, without neglecting the other exercises of the school.

The above reasons have induced me to publish this compendium, earnestly wishing that by this little Treatise, the Master, who shall think it worthy of his use, may be eased of the heavy task of writing rules, &c. and the Scholar's improvement in the most useful part of Arithmetic facilitated.

I have consulted the advantage of common Schools in the collection of my *Rules* and *Examples*, endeavoring to make them plain and useful. As for *Curiosities*, *Pleasing Questions*, &c. they must be left for those who have more leisure than most of our country youth.

There being no established order, in which the rules of Arithmetic should be arranged, I have endeavored to place them so, that each shall have as little dependence on a succeeding one as possible—however, every teacher is left to his choice in that respect. The rules are concise and comprehensive; the examples, practically and clearly expressed, void of ambiguous expressions, which serve more to perplex than instruct.

Scholars in general are not in the least profited by having the examples or questions wrought at large in the Arithmetic.* It may do very well for a private use; but in a school under the direction of an able teacher, it is not necessary; besides, it takes up a large proportion of room, and either swells the book in size and price, or prevents the insertion of many questions. Three or four questions may be inserted in the place it would take to set down the work of one.

When a scholar begins a rule, the method I take is this—First, I explain the nature of it, its use in business, bringing in natural occurrences to convey the idea. Then I take a question in the rule, and work it at large, reasoning as I go on, shewing why I proceed thus and so. My scholars well remember (or ought to remember) an expression I often use—*Compute by Reason, not by Guess.* By this method a scholar will obtain more knowledge than he would by reading a long chain of rules, or by having the examples wrought at large.

N. B. If such gentlemen, as think it worth their attention, will communicate to me any errors they may occasionally find in the use of this compendium, they shall receive my grateful acknowledgments.

PHINEHAS MERRILL.

* I mean an Arithmetic for the use of our common schools, in the hands of young lads who depend pretty much on the master for verbal explanation.

EXPLANATION

OF THE CHARACTERS USED IN THIS COMPENDIUM.

= THIS is the sign of equality: as 10 dimes = to 1 dollar: read thus, 10 dimes are equal to 1 dollar.

+ This is the sign of addition, or more: as $4+5=9$; read thus, 4 added to 5, or 4 more 5 are equal to 9.

— This is the sign of Subtraction, or less; as $12-4=8$; read thus, 12 less by 4, equal to 8.

× This is the sign of Multiplication, or into: as $6\times3=18$; read thus, 6 multiplied by 3, or into 3, are equal to 18.

÷ This is the sign of Division: as $24\div6=4$; read thus, 24 divided by 6 equal to 4 or $\frac{24}{6}=4$.

: This signifies *to.* :: This signifies *so is.* The two last characters put together thus, : :: : are the sign of proportion, thus, 2:4::8:16; thus read, as 2 to 4, so is 8 to 16, viz. 2 bears the same proportion to 4 as 8 does to 16.

Example. $7\times3+4-1\div8=3$, thus read, 7 into 3, more 4, less 1, divided by 8, equal to 3.

A TABLE

Containing the denominations of the Federal Money, with their weight and value, agreeably to an act of Congress, passed April 2, 1792.

GOLD PIECES.

Eagle, val.	10 dols.	$247\frac{1}{2}$	grs. pure gold, or,	270	grs. stan. gold.
$\frac{1}{2}$Eagle	5	$123\frac{3}{4}$	do.	135	do.
$\frac{1}{4}$Eagle	$2\frac{1}{2}$	$61\frac{7}{8}$	do.	$67\frac{1}{2}$	do.

SILVER PIECES.

Dollar—to be of the value of the Spanish milled dollar, as the same is now current.

To contain	$371\frac{4}{16}$	grs. pure silver, or,	416	grs. of stand. silver.
$\frac{1}{2}$Dollar,	$185\frac{10}{16}$	do.	208	do.
$\frac{1}{4}$Dollar,	$92\frac{13}{16}$	do.	104	do.

Dime—to be of the value of one tenth of a dollar.

To contain	$37\frac{2}{16}$	do.	$41\frac{3}{5}$	do.
$\frac{1}{2}$Dime,	$18\frac{9}{16}$	do.	$20\frac{4}{5}$	do.

COPPER PIECES.

Cent, to be of the value of one hundredth of a dollar—to contain (agreeably to an Act of Congress, passed January 14, 1793) 208 grains of copper—$\frac{1}{2}$Cent, 104 grains of copper.

Standard for gold coins, and alloy how to be regulated, agreeably to the act aforesaid.

The standard for all gold coins of the United States, shall be 11 parts fine to 1 part alloy; and accordingly that 11 parts in 12 of the entire weight of each of the said coins shall consist of pure gold, and the remaining one twelfth part of alloy—said alloy to be composed of silver and copper. See the 43d example in the Rule of Three Direct.

Standard for silver coins and alloy, how to be regulated, agreeably to said act.

The standard for all silver coins of the United States shall be 1485 parts fine to 179 parts alloy, and accordingly, that 1485 parts in 1664 parts of the entire weight of each of the said coins shall consist of pure silver, and the remaining 179 parts of alloy, which alloy shall be wholly of copper. See the 7th example in the Rule of Three Direct, in Decimals.

Proportional value of gold to silver, by said act.

The proportional value of gold to silver in all coins, which shall by law be current as money within the United States, shall be as 15 to 1, according to quantity in weight, of pure gold or pure silver; that is to say, every 15lbs. weight of pure silver shall be of equal value in all payments, with 1 lb. weight of pure gold, and so in proportion for greater or less quantities. See the 8th example in the Rule of Three Direct, in Decimals.

NOTE.—One dollar is worth 27 grains of standard gold. The weight of the gold and silver coins in the foregoing table, the alloy, &c. are computed according to the Act of Congress.

ARITHMETIC.

ARITHMETIC is the art of computing by numbers, and has five principal or fundamental rules for its operation, viz. NOTATION, ADDITION, SUBTRACTION, MULTIPLICATION, and DIVISION.

NOTATION.

NOTATION, or Numeration teaches to write, read, and express any proposed number. For the better understanding of which, observe the following Table.

Hundreds of Millions.	Tens of Millions.	Millions.	Hundreds of Thousands.	Tens of Thousands.	Thousands.	Hundreds.	Tens.	Units.
1	2	3	4	5	6	7	8	9
	1	2	3	4	5	6	7	8
		1	2	3	4	5	6	7
			1	2	3	4	5	6
				1	2	3	4	5
					1	2	3	4
						1	2	3
							1	2
								1

Million's place.			Thousand's place.			Hundreds.	Tens.	Units.
9	8	7	6	5	4	3	2	1
	9	8	7	6	5	4	3	2
		9	8	7	6	5	4	3
			9	8	7	6	5	4
				9	8	7	6	5
					9	8	7	6
						9	8	7
							9	8
								9

To Read Numbers.

To the simple value of each figure, join the name of its place, beginning at its left hand, and reading towards the right.

NOTE.—In common business we seldom, if ever, have occasion to enumerate more than nine figures, therefore I have omitted all examples exceeding that number.

SIMPLE ADDITION.

SIMPLE ADDITION is the adding together several numbers of the same kind.

RULE.—Place the number to be added so that units may stand under units, tens under tens, &c. and draw a line under them.

2. Add up the figures in the row of units, and find how many tens are contained in their sum.

3. Set down the remainder, and carry as many ones to the next row, as there are tens; with which proceed as before; and so on until the whole is finished.

Method of Proof.

1. Draw a line below the uppermost number, and suppose it cut off.

2. Add all the rest together, and set their sum under the number to be proved.

3. Add the last found number, and the uppermost line together, and if their sum be the same as that found by the first addition, the work is right.

EXAMPLES.

S.	£.	Yds.	Miles.	Dolls.	Tons.	Days.
4	9	14	26	127	763	4507
—	8	12	32	343	536	9876
2	6	11	27	761	728	7643
3	7	16	12	321	916	9647
5						
sum 14						
10						
proof 14						

Hours.	Leagues.	Degrees.	Ells.
14676	124678	98742674	1000
20740	499476	7626264	20
42674	846764	47462	426
10764	762600	540	5000
17267	106246	7	29

SIMPLE SUBTRACTION.

Simple Subtraction teaches to take a less sum from a geater of the same denomination, and thereby shews the difference or remainder.

Rule 1. Place the least number under the greatest, so that units may stand under units, and tens under tens, &c. and draw a line under them.

2. Begin at the right hand, and take each figure in the lower line from the figure above it, and set down the remainder.

3. If the lower figure be greater than that above it, add ten to the upper number; from which number, so increased take the lower, and set down the remainder, carrying one to the next lower number; with which proceed as before, and so on until the whole is finished.

Method of Proof.

Add the remainder to the last number, and if the sum be equal to the greatest, the work is right,; or by subtracting the remainder from the greatest line, and that difference will be equal to the lower line, if the work be right.

EXAEPLES.

	£.	d.	yds.	qrs.	s.	gal.	days
From	96	48	72	61	266	9701	1000
Take	54	27	24	59	177	4816	999
Rem.	42						
Proof	96						

	Miles.	Hours.	Leagues.	Minutes.
From	57261	100769	92617928	14077827
Take	54691	91001	1768979	12631238
Diff.				

SIMPLE MULTIPLICATION.

SIMPLE MULTIPLICATION is the multiplying of any two numbers together, of one denomination.

The number to be multiplied is called the Multiplicand.

The number you multiply by is called the Multiplier.

The number found from the operation is called the Product.

Both the multiplier and multiplicand are, in general, called Factors.

NOTE.—The following Table must be learned perfectly by heart.

MULTIPLICATION TABLE.

3 times	3	are	9	5 times	6	are	30	11 times	3	are	33
	4		12		7		35		4		44
	5		15		8		40		5		55
	6		18		9		45		6		66
	7		21	6 times	6		36		7		77
	8		24		7		42		8		88
	9		27		8		48		9		99
4 times	4		16		9		54	12 times	3		36
	5		20	7 times	7		49		4		48
	6		24		8		56		5		60
	7		28		9		63		6		72
	8		32	8 times	8		64		7		84
	9		36		9		72		8		96
5 times	5		25	9 times	9		81		9		108

CASE I.

To multiply by single figures.

RULE.—Multiply every figure in the multiplicand by the figure in the multiplier, carrying one for every ten, as in Simple Addition, and you have the product.

EXAMPLES.

£.	yds.	ounces.	bushels.	gallons.
462	4067	18945	626487	62876467
2	3	4	5	6
924				

miles.	pounds.	hours.	nails.
9876574	8764567	71870261	14676284
7	8	9	12

CASE II.

To multiply by several figures.

RULE 1.—Place the multiplier under the multiplicand, so that units may stand under units, &c.

2 Begin at the right hand, and multiply the whole multiplicand severally by each figure in the multiplier, setting down the first figure of every line directly under the figure you are multiplying by, and carry for the tens as in case 1.

3. Add all the lines together, and their sum is the product. nines in the total product, the work is right.*

Method of Proof.

Cast the nines out of the two factors, and set down the remainder. Multiply the two remainders together, and if the excess of nines in their product, be equal to the excess of

EXAMPLES.

4215 3=excess of nines in the multiplicand.
875 2=excess of nines in the multiplier.

21075 6
29505
33720

3688125 6 excess of nines in the product, and proves the work to be right.

*This is a very simple, easy method of proof, but it is liable to this inconvenience, that a wrong operation may sometimes appear to be right: for if we change the place of any two figures in the product, it

Multiply 691861 by	26	Product	17988386
Multiply 129186 by	98	Product	12660228
Multiply 281216 by	978	Product	275029248
Multiply 181281 by	763	Product	138317403
Multiply 269181 by	4629	Product	1246038849
Multiply 261986 by	7638	Product	2001049068
Multiply 812617 by	43859	Product	35640569003
Multiply 281691 by	76286	Product	21489079626
Multiply 8496427 by	874359	Product	7428927415293
Mult. 987654321 by	123456789	Prod.	121932631112635269

CONTRACTIONS.

I. *When there are cyphers to the right hand of one or both numbers to be multiplied—*

Rule 1.—Place the numbers one under another, as if there were no cyphers.

2. Proceed as before, neglecting the cyphers, and to the right hand of the product place as many cyphers as are in both number.

EXAMPLES.

Multiply 476000 by	170	Product	80920000
Multiply 180120 by	48100	Product	8663772000
Multiply 760000 by	4800	Product	3648000000
Multiply 461200 by	72000	Product	33206400000

II. *When the multiplier is an unit with any number of cyphers annexed.*

Rule.—Affix as many cyphers to the multiplicand, as there are cyphers in the multiplier, and it will make the product required.

EXAMPLES.

Multiply 746126 by	100	Product	74612600
Multiply 1976870 by	1000	Product	1976870000

III. *When cyphers are placed between the significant figures in the multiplier.*

Rule.—Such cyphers must be omitted in the operation, regard being had to the first figure of every particular product as before.

EXAMPLES.

Multiply 128121 by	72001	Product	9224840121
Multiply 128128 by	70043	Product	8974469504
Multiply 246145 by	66012	Product	16248523740

will still be the same; but a true product will always appear to be true by this proof, and to make a false one appear true, there must at least be two errors, and these opposite to each other: and if there be more than two errors, they must balance among themselves; but the chance against this particular circumstance is so great, that we may as safely trust to this proof as any other.

IV. *When the multiplier is the product of two or more numbers in the table.*

RULE.—Multiply continually by those parts instead of the whole number at once.

EXAMPLES.

Multiply	764126	by	35	Product	26744410
Multiply	764131	by	48	Product	36678288
Multiply	461231	by	72	Product	33208632
Multiply	124215	by	108	Product	13415220

SIMPLE DIVISION.

SIMPLE DIVISION teaches to find how often one number is contained in another of the same denomination, and thereby performs the work of many subtractions.

The number to be divided is called the Dividend.

The number you divide by is called the Divisor.

The number of times the Dividend contains the Divisor is called the Quotient or answer.

If the dividend contain the divisor any number of times, and some parts over, those parts are called the remainder, and are always less than the divisor, and of the same name with the dividend.

RULE 1.—On the right and left hand of the dividend, draw a curved line, and write the divisor on the left hand, and the quotient as it arises, on the right.

2. Find how many times the divisor may be had in as many figures of the dividend as are just necessary, and write the number in the quotient.

3. Multiply the divisor by the quotient figure, and set the product under that part of the dividend used.

4. Subtract the last found product from the part of the dividend under which it stands, and to the right hand of the remainder bring down the next figure of the dividend, which number divide as before, and so on, till the whole is finished.

Method of Proof.

Multiply the quotient by the divisor, and the remainder, if there be any, add to the product; that sum will be equal to the dividend, if the work be right.

EXAMPLES.

```
              Dividend.
Divisor 32)78901(2465 Quotient.
           64                2465
           --                  32
           149               ----
           128               4930
           ---               7395
            210              -----
            192              78880
            ---                 21+
             181             -----
             160             78901 Proof.
             ---
             21 Remainder.
```

2. Divide 19260 by 16 — Ans. 1284
3. Divide 46242 by 252 — Ans. $183\frac{126}{252}$
4. Divide 647395 by 756 — Ans. $856\frac{259}{756}$
5. Divide 5017846 by 293 — Ans. $17125\frac{221}{293}$
6. Divide 123456789 by 365 — Ans. $338237\frac{284}{365}$
7. Divide 3104675846 by 833 — Ans. $3727101\frac{713}{833}$
8. Divide 24172196 by 375 — Ans. $64459\frac{71}{375}$
9. Divide 821695074 by 5267 — Ans. $156008\frac{938}{5267}$
10. Divide 293839455936 by 8405 — Ans. $34960078\frac{346}{8405}$
11. Divide 4637064283 by 57606 — Ans. $80496\frac{11707}{57606}$

CONTRACTIONS.

I. *When the divisor does not exceed* 12—

RULE.—Find the first quotient figure as before, but place it under that part of the dividend used—if any thing remain, suppose it placed before the next quotient figure, with which proceed as before, and so on till the whole is finished.

NOTE.—This is commonly called Short Division.

EXAMPLES.

```
2)462        3)6421      4)70641      5)107142         6)54626
Quo. 231                              Quo. 21428(2)
       2                                     5
  ------     ------      ------       -----------      ------
Proof 462                             Proof 107142
```

6. Divide 9876543210 by 8 — Ans. $1234567901\frac{2}{8}$
7. Divide 12345678900 by 7 — Ans. $1763668414\frac{2}{7}$
8. Divide 1357975313 by 9 — Ans. $150886145\frac{8}{9}$
9. Divide 507196332 by 12 — Ans. $47516365\frac{2}{12}$

II. *When cyphers are placed at the end of the divisor.*

RULE 1.—Cut off the cyphers from the divisor, and the same number of places from the right hand of the dividend

\# 570196382

2. Those figures, which are cut off in the dividend, must be annexed to the remainder at last.

EXAMPLES.

1. Divide 3108690170 by 7100 Ans. $437843\frac{4870}{7100}$
2. Divide 7380964 by 23000 Ans. $320\frac{20964}{23000}$
3. Divide 310869017 by 200 Ans. $1554345\frac{17}{200}$

III.—*When the Divisor is the product of two or more small numbers in the table.*

Rule.—Divide continually by those numbers, instead of the whole divisor at once.*

EXAMPLES.

1. Divide 31046835 by 56 Ans. $554407\frac{43}{56}$
2. Divide 7014596 by 72 Ans. $97424\frac{68}{72}$

COMPOUND ADDITION.

Compound Addition teaches to collect several numbers of different denominations into one total.

Rule I.—Place the numbers so that those of the same denomination may stand directly under each other, and draw a line below them.

2. Add up the figures in the lowest denomination, and see how many ones of the next higher denomination are contained in their sum.

3. Write down the remainder, and carry the one to the next denomination with which proceed as before and so on through all the denominations to the highest, whose sum must all be written down.

The method of proof is the same as in Simple Addition.

EXAMPLES OF MONEY.

4 Farthings make	1 Penny.	Pounds are marked	£.
12 Pence	1 Shilling.	Shillings	s.
20 Shillings	1 Pound.	Pence	d.
		Farthings	qrs.

	£.	s.		£.	s.		£.	s.	d.		£.	s.	d.	qrs.
	12	4		100	10		76	10	7		146	18	10	3
	5	6		42	12		27	4	2		426	14	5	2
	10	1		76	16		28	11	7		71	8	4	1
	9	4		104	6		4	6	1		6	10	11	2
Sum	36	15												
	24	11												
Proof	36	15												

* When there is any remainder in the first division, or last, or both; to know the true remainder, multiply the first Divisor by the last Remainder, and take in the first remainder, if there be any, the product will be the true remainder.

A farthing is generally set down after pence thus $\frac{1}{4}$; two farthings, or an halfpenny, thus $\frac{1}{2}$; three farthings, thus.

£.	s.	d.	£.	s.	d.	£.	s.	d.
446	19	$10\frac{1}{2}$	46	12	11	1000	14	$10\frac{1}{2}$
106	14	11	21	16	$9\frac{1}{4}$	10	4	$0\frac{1}{4}$
19	6	$4\frac{3}{4}$	26	14	$11\frac{1}{4}$	99	16	6
764	14	$10\frac{1}{4}$	4	8	$1\frac{3}{4}$	463	11	$11\frac{1}{4}$
4	6	$6\frac{1}{2}$	9	19	$0\frac{1}{2}$	1462	7	4

ADDITION OF THE FEDERAL MONEY.

Note.—10 Mills make	1 Cent, marked		c.
10 Cents	1 Dime,		d.
10 Dimes	1 Dollar,		D.
10 Dollars	1 Eagle,		E.

Although calculations by the Federal Money may be easily and naturally performed by Decimal Fractions, (where I shall introduce it in its natural order) yet, for the benefit of many adults, who have not become acquainted with Fractions, and many youth, perhaps apprentices, who cannot attend school but a short time, I have introduced, and shall treat of the Federal Money in whole numbers.*

Addition of the Federal Money is performed the same as Simple Addition, observing to place a comma between the dollars and dimes; setting dollars under dollars, dimes under dimes, &c.

Note 1.—The dollars occupy the first place at the left hand of the comma, and all the places at the left hand of dollars are eagles; but eagles and dollars reckoned together, express the number of dollars contained in the sum, as 8E. 5D. are equal to 85 D. 12E. 4D. are equal to 124 D.

2. The dimes possess the first place at the right hand of the comma, and cents the second place; but dimes and cents reckoned together express the number of cents contained in the sum, as 4d. 5c. are equal to 45c.

---

* Any computation in the common business of life may be performed very accurately by Federal Money, in whole numbers. My method is this, I express the sum in cents (or mills if I want to be very nice) and in this denomination I keep it through the whole operation required by the question, until I bring out the answer, which will be cents, (or mills, if expressed so at first.) I was advocating this doctrine not long since in the presence of one of my brother pedagogues, who I believe thought the Federal Money must be wholly confined to a decimal operation. He asked me to divide two cents equally among three hundred men? I did it—but was obliged to express the answer decimally; so the laugh went against me.

I asked him if he could compute by L. money in whole numbers? He answered in the affirmative. I then asked him to divide two shillings equally among three hundred men? He readily saw there was not a farthing a piece for the men, and of consequence the answer must be a decimal expression of a farthing. But such questions do not often occur in common business.

3. The mills possess the third place from the right hand of the comma, and dimes, cents and mills reckoned together, express the number of mills contained in the sum, as 4d. 2c. 7m. are equal to 427m.

4. From what has been said it appears, and must be remembered, that any sum of this money, whether it be eagles dollars, dimes, cents or mills, shows the number of each different piece of money contained in it, as 645467 mills, are equal to 64E. 5D 4d 6c. 7m.—64546 cents, are equal to 64 E. 5D 4d.6c —6454 dimes, are equal to 64E.5D.4d —645 dollars, are equal to 64E. 5D. which will appear thus,

	E.	D.	d.	c.	m.
645467 mills, are equal to	64	5,	4	6	7

5 Any sum of this money may easily be changed from one name to another, and still retain the same value.

Large pieces, as eagles, &c. may be expressed in small ones by filling the places with cyphers, between the name it stands in, and the name you would express it in.

EXAMPLES.

1. Express 5 Eagles in dollars, dimes, cents and mills. 5E. equal to 50D. equal to 500d. equal to 5000c. equal to 50,000 m.

2. Express 6D. 5d. in cents and mills. 6D. 5d. equal to 650c. equal to 6500m.

The learner will readily see the method of expressing small names in large ones. viz. If the sum stands in mills, point off three figures or places from the right hand of the sum, which will be dimes, cents and mills; if in cents, two places, which will be dimes and cents; if in dimes, one place, which will be dimes.

EXAMPLES.

1. Express 74674 mills in eagles, &c.

	E.	D.	d.	c.	m
74674 m. equal to	7	4	6	7	4

2. Express 456 cents, in dollars, &c.

	D.	d.	c.
456c. equal to	4,	5,	6.

	D.	d.	c.	m.	E.	D.	d.	c.	m.	d.	c.	m.
Add	41,	4	2	6	46	8,	6	4	0	,4	5	0
	4,	6	1	0		1,	9	2	5	,7	6	5
	65,	0	6	2	74	6,	0	0	0	,9	2	0
	86,	9	2	3	7	6,	4	5	3	,7	4	5
Sum	198,	0	2	1						2,8	8	0
	156,	5	9	5						2,4	3	0
Proof	198,	0	2	1						2,8	8	0

*TROY WEIGHT.

24 grains, or *gr.*	make	1 penny-weight, marked	*pwt.*
20 penny-weights		1 ounce,	*oz.*
12 ounces		1 pound,	*lb.*

By this weight are weighed jewels, gold, silver, corn, bread and liquors.

lb.	*oz.*	*pwt.*	*gr.*	*lb.*	*oz.*	*pwt.*	*gr.*	*lb.*	*oz.*	*pwt.*
646	10	16	14	4	11	4	23	10	10	16
174	11	9	22	4	9	0	16	7	10	19
87	4	19	19	8	10	12	0	4	9	4
12	7	6	7	0	9	16	20	2	0	14
196	10	18	14	4	11	13	11	7	11	6

AVOIRDUPOIS WEIGHT.

16 drams, or *dr.*	make	1 ounce, marked	*oz.*
16 ounces		1 pound,	*lb.*
28 pounds		1 quarter	*qr.*
4 quarters		1 hundred	*cwt.*
20 hundred		1 ton	*T.*

By this weight are weighed all things, of a coarse and drossy nature, and all metals except gold and silver.

cwt.	*qrs.*	*lb.*	*oz.*	*dr.*	*T.*	*cwt.*	*qr.*	*lb.*	*qrs.*	*lb.*	*oz.*	*dr.*
14	2	14	10	11	1	14	1	14	144	20	15	14
14	1	21	9	15	7	0	3	0	71	19	10	11
76	3	27	15	4	2	19	2	11	147	14	6	6
12	2	13	1	0	7	14	0	9	9	0	9	11
90	1	0	11	14	1	6	1	13	126	27	11	8

APOTHECARIES WEIGHT.

20 grains	make	1 scruple.
3 scruples		1 dram.
8 drams		1 ounce.
12 ounces		1 pound.

NOTE.—Apothecaries use this weight in compounding their medicines, but they buy and sell their drugs by Avoirdupois weight.

lb.	*oz.*	*dr.*	*sc.*	*gr.*	*lb.*	*oz.*	*dr.*	*sc.*	*gr.*
746576	5	7	2	17	740	10	7	1	19
126762	1	4	1	14	749	0	3	0	16
964764	7	2	1	16	906	9	6	2	4
164626	9	4	2	19	746	11	6	2	14
146476	6	2	1	4	262	10	1	1	11

* *One pound Troy is equal to 13oz. $2\frac{11}{175}$ dr. Avoirdupois. One ounce Troy is equal to 1oz. $1\frac{43}{100}$ dr. Avoirdupois. One pound Avoirdupois is equal to 1lb. 2oz. 11pwt 16gr. Troy. One ounce Avoirdupois is equal to 18pwt. $5\frac{1}{2}$ gr. Troy.*

LONG MEASURE.

3 barley corns	make	1 inch.
12 inches		1 foot.
3 feet		1 yard.
6 feet		1 fathom.
5 yards and a half		1 pole, rod or perch.
40 poles		1 furlong.
8 furlongs		1 mile.
3 miles		1 league.
60 geographical miles, or 69½ statute miles,		1 degree.

360 degrees, circumference of the earth.

Mi.	fu.	po.	yd.	ft.	in.
741	2	36	2	1	3
47	7	24	4	2	9
326	4	38	2	0	8
526	4	28	2	0	8
720	6	20	2	2	7
96	3	27	3	0	7

le.	mi.	fu.	po.	yd.	ft.	in.
6	2	6	20	1	2	3
2	2	2	30	2	2	9
2	2	7	24	0	0	8
4	0	7	24	4	2	9
3	2	0	27	5	2	6
7	2	2	9	4	2	7

CLOTH MEASURE.

2 inches and a quarter	make	1 nail.
4 nails		1 quarter of a yard.
3 quarters		1 Flemish ell.
4 quarters		1 yard.
5 quarters of a yard		1 English ell.

Yds.	qrs.	na.
7464	2	2
46	3	2
734	2	3
9724	2	2
94	3	3

Fl. ells.	qrs.	na.	in.
4267	2	2	2
9007	2	3	2
426	2	0	2
46	0	2	0
2237	2	3	2

En. ells.	qrs.	na.	in.
764	4	2	2
246	3	3	0
976	2	1	2
796	3	2	2
738	3	2	0

WINE MEASURE.

All brandies, spirits, perry, cyder, and oil are measured by this measure.

2 pints	make	1 quart.
4 quarts		1 gallon.
42 gallons		1 tierce.
63 gallons		1 hogshead.
84 gallons		1 puncheon.
2 hogsheads		1 pipe or butt.
2 pipes		1 ton.

NOTE.—The wine gallon contains 231 solid inches.

Tuns.	Hhds.	gal.	qt.	Tierces.	gal.	qt.	Hhds.	gal.	qt.	pt.
746	1	21	2	476	26	2	746	60	1	1
146	1	21	2	906	27	1	146	17	1	0
76	1	60	3	468	14	1	726	48	3	1
174	3	86	1	725	17	2	969	9	2	0
476	1	16	1	261	11	1	126	14	1	1

ALE AND BEER MEASURE.

2 pints	make	1 quart.
4 quarts		1 gallon.
8 gallons		1 firkin of ale.
9 gallons		1 firkin of beer.
2 firkins		1 kilderkin.
2 kilderkins		1 barrel.
3 kilderkins		1 hogshead.
3 barrels		1 butt.

NOTE.—The ale gallon contains 282 solid inches.

Beer. hhds.	gal.	qt.	Ale. bar.	fir.	gal.	Beer. bar.	fir.	gal.
764	10	1	7467	2	4	796	1	7
462	15	1	9646	3	7	146	1	8
947	42	3	7262	1	6	716	3	7
187	17	0	76	2	2	723	3	6
76	30	2	9	3	7	124	1	8

DRY MEASURE.

2 pints	makes	1 quart.
4 quarts		1 gallon.
2 gallons		1 peck.
4 pecks		1 bushel.
8 bushels		1 quarter.
5 quarters		1 wey or load.
36 bushels		1 chaldron in London.

Loads.	qrs.	bu.	pe.	gal.	Loads.	qrs.	bu.	pe.	gal.
7462	4	2	2	1	7659	2	5	3	1
6264	3	7	3	1	8890	4	4	2	0
2626	3	5	1	0	9358	3	3	0	1
6326	2	4	3	0	9850	2	0	3	0
7349	2	4	3	1	8503	0	7	2	1

TIME.

60 seconds	make	1 minute.
60 minutes		1 hour.
24 hours		1 day.
7 days		1 week.
4 weeks		1 month.

months, 1 day, 6 hours, 1 common or Julian year

According to the best computation, a solar year is 365 days, 5 hours, 48 minutes and 55 seconds, and are thus divided into months:

Ne more days than 30 hath the month of September,
The same may be said of June, April, November;
The rest of the months have just thirty and one,
Except that short month February alone;
Which to itself claimeth just eight and a score,
But in every leap year we give it one more.

Years.	mo.	we.	da.	ho.	min.	sec.
24626	10	2	4	12	50	40
1476	2	3	6	19	34	38
26744	7	3	4	9	7	9
97496	4	2	4	23	33	44
33	9	1	5	3	43	6

Mo.	we.	da.	ho.	min.
4	3	6	20	17
7	3	2	9	8
7	3	4	5	36
9	3	0	23	44
8	3	4	5	9

Questions to Exercise Addition.

1. Add 8635, 2194, 7421, 5063, 2196, and 1245 together.
Ans. 26754.

2. A man was born in the year 1762, I demand when he will be 57 years of age? Ans. in the year 1819.

3. A man borrowed a sum of money, and paid in part £.12 10*s.* and the remainder £.17 10*s.* what was the sum borrowed? Ans £.30.

4. A owes me £.15 9*s.* B £.100 14*s* 4½*d.* C £.11 11*s.* 10¼*d.* D £.108, how much is the sum? Ans £.235 15*s.* 2¾*d.*

5. Borrowed of A. 2½ eagles, of B 1½ dollar, of C 88 cents of D 9½ cents; how much is the sum? Ans. 27D 4d. 7½c.

6. A factor bought 4 bags of hops; No. 1 weighed 2*cwt.* 1*qr.* 14*lb.*; No. 2. 3*qrs.* 17*lb.*; No. 3. 2*cwt.* 3*qrs.* 13*lb.*; and No. 4. 1*qr.* 27*lb.*; what is the weight of all?
Ans. 6*cwt.* 2*qr.* 15*lb.*

COMPOUND SUBTRACTION.

Compound Subtraction teaches to find the difference of any two numbers of different denominations.

Rule 1. Place the least number under the greatest, so that those parts which are of the same denomination may stand directly under each other, and draw a line below them.

2. Begin at the right hand, and take each figure of the lower line from the figure standing above it, and set down the remainder.

3. But if the figure below be greater than that above it, increase the upper number by as many as make one of the next higher denomination, and from this sum take the figure in the lower line, and set down the remainder as before.

4. Carry the unit borrowed to the next number in the lower line, and subtract as before; and so on till the whole is finished. The method of proof is the same as in Simple Subtraction.

EXAMPLES OF MONEY.

	l.	*s.*	*l.*	*s.*	*d.*	*l.*	*s.*	*d.*	*l.*	*s.*	*d.*
From	42	8	9	11	6	74	17	$10\frac{1}{4}$	10	10	$1\frac{1}{2}$
Take	14	6	2	16	8	9	17	$10\frac{1}{2}$	9	19	4
Rem.	28	2									
Proof	42	8									

	l.	*s.*	*d.*	*l.*	*s.*	*d.*	*l.*	*s.*	*d.*	*l.*	*s.*	*d.*
From	146	10	10	40	0	$1\frac{1}{2}$	1	10	$6\frac{3}{4}$	10	14	$6\frac{1}{4}$
Take	128	14	$11\frac{1}{4}$	39	19	$2\frac{1}{4}$		11	$7\frac{3}{4}$		10	$0\frac{1}{2}$
Diff.												

FEDERAL MONEY.

	D.	*d.*	*c.*	*m.*	*D.*	*d.*	*c.*	*m.*	*E.*	*D.*	*d.*	*c.*	*m.*
From	76,	9	4	2	146,	0	1	0	1687	4,	0	0	0
Take	8,	9	7	4	76,	2	8	6	4	8,	7	6	4
Diff.	67,	9	6	8									
Proof	76,	9	4	2									

TROY WEIGHT.

	lb.	*oz.*	*pwt.*	*gr.*	*lb.*	*oz.*	*pwt.*	*gr.*	*lb.*	*oz.*	*pwt.*	*gr.*
From	7	4	6	14	1	0	16	20	144	1	1	8
Take	5	7	15	16		10	16	21		11	4	11
Rem.												

AVOIRDUPOIS WEIGHT.

	Cwt.	*qrs.*	*lb.*	*oz.*	*dr.*	*Cwt.*	*qrs.*	*lb.*	*oz.*	*dr.*	*lb.*	*oz.*	*dr.*
From	4	1	14	10	4	10	2	26	1	2	144	9	13
Take	1	0	19	11	12	10	0	26	11	13	66	12	15
Diff.													

LONG MEASURE.

	Le.	*mi.*	*fur.*	*po.*	*yd.*	*ft.*	*in.*	*Mi.*	*fur.*	*po.*	*yd.*	*ft.*	*in.*
From	14	1	5	14	1	1	7	7	2	16	2	1	1
Take	7	2	5	27	2	1	10	1	7	19	2	2	7
Diff.													

CLOTH MEASURE.

	Yds.	qr.	na.	En.ells.	qr.	na.	Fl.ells.	qr.	na.	yds.	qr.	na.
From	74	1	2	726	1	1	107	0	2	416	2	1
Take	40	0	3	94	2	1	31	1	3	414	2	3
Diff.												

WINE MEASURE.

	Tuns.	hhds.	gal.	qt.	Tierces.	gal.	qt.	Tuns.	hhds.	gal.	qt.
From	76	2	16	1	1741	9	2	1409	1	14	1
Take	4	2	31	2	1146	9	3	991	2	17	2
Diff.											

ALE AND BEER MEASURE.

	Hhds.	fir.	gal.	qt.	A. bar.	fir.	gal.	B.bar.	fir.	gal.	qt.	pt.
From	79	2	3	3	146	1	4	745	2	4	1	0
Take	9	4	4	3	9	1	6	718	3	4	2	1
Rem.												

DRY MEASURE.

	Loads.	qrs.	bu.	pe.	Loads.	qrs.	bu.	pe.	qrs.	bu.	pe.	gal.
From	140	2	5	0	176	1	2	1	75	6	1	0
Take	99	3	4	1	128	4	2	0	7	7	2	1
Rem.												

TIME.

	Mo.	we.	da.	ho.	mi.	sec.	Mo.	we.	da.	ho.	mi.	sec.
From	14	1	4	14	17	10	10	2	2	7	10	24
Take		2	6	21	51	33	1	3	4	9	15	11

Questions to Exercise Subtraction.

1. From 78213606 take 27821890. Ans. 50391716.

2. General Washington was born in the year 1732, how old was he in the year 1798? Ans. 66.

3. Sir Isaac Newton was born in the year 1642, and died in the year 1727, how old was he at the time of his decease? Ans. 85.

4. A boy had a thousand marbles, and he lost at 3 different times at play, each 175, and at another time 150; how many has he still in hand? Ans. 325.

5. A man is 32 years old this year, viz. 1802, what year was he born in? Ans. in the year 1770.

6. A man borrowed £.30, and paid in part £.12 10s. how much is yet due? Ans. £.17 10s.

7. A is indebted to the Tanner £.15, B owes him £.9 11s. 0¾d. how much does one owe more than the other?
Ans. £.5 8s. 11¼d.

8. What sum must I take out of £.100 to have the remainder £.58 14s. 6¾d.? Ans. £.41 5s. 5¼d.

9. Borrowed 25¼ dollars and paid in part, 16¾, how much is due? Ans. 8½ dollars.

10. From £.1000 take ¼d. Remainder £.999 19s. 11¾d.

COMPOUND MULTIPLICATION.

Compound Multiplication teaches to find the amount of any given number of different denominations by repeating it any proposed number of times.

GENERAL RULE.

Multiply the price by the quantity, and carry as in Compound addition.

If the quantity exceed 12, and can be found in the table, multiply by the component parts; if it cannot be found in the table, find the nearest to it, either greater or less, and proceed as before, and to or from the last product, add or subtract the produce of as many as it is less or greater than the given quantity.

Method of Proof.

Invert the order of the component parts, or, take them another way. Quantities under 12 may be proved by taking their component parts, if in the table, if not, add or subtract as above directed.

PREPARATORY EXAMPLES.

L.	s.	d.	L.	s.	d.	L.	s.	d.	L.	s.	d.
56	15	10½	7	4	5¼	60	10	11	0	16	4½
		4			3			5			7
227	3	6							5	14	7

Proof. Proof. Proof. Proof.

L.	s.	d.	L.	s.	d.	L.	s.	d.	s.	d.
56	15	10½	7	4	5¼	60	10	11	16	4½
	2×2=4			2+1=3			4+1=5		6+1=7	
113	11	9					L.4 18	3		
		2							16	4½
227	3	6					5 14	7½		

Quantities from 2 to 12.

1. What cost 9 gallons of brandy, at 9*s.* 6½*d.* per gallon?

	s.	*d.*			*s.*	*d.*	
	9	6½ per gallon.			9	6½	
		9 the quantity.					3×3=9 the quantity.
Ans *L.*4	5	10½		1	8	7¼	
						3	
				*L.*4	5	10½	Proof--which shews the first operation to be right

2. 2 bushels of wheat at 4*s.* 6*d.* per bushel. Ans. 9*s.*
3. 3 pounds of tea, at 9*s.* 6*d.* per lb. Ans. *L.*1 8*s.* 6*d.*
4. 5 pounds of loaf sugar, at 1*s.* 6½*d.* per lb. Ans. 7*s.* 8½*d.*
5. 6 gallons of wine, at 5*s.* 4*d.* per gallon. Ans. *L.* 1 12*s.*
6. 7 pounds of tobacco, at 1*s.* 8¼*d.* per lb. Ans. 11*s.* 11¾*d.*
7. 8 pounds of indigo, at 15*s.* 6*d.* per. lb. Ans. *L.*6 4*s.*
8. 9 cwt. of beef, at *L.*1 11*s.* 5*d.* per. cwt. Ans. *L.*14 2*s.* 9*d.*
9. 12 cows, at *L.*4 15*s.* 4*d.* per cow. Ans. *L.*57 4*s.*

Quantities exceeding 12 found in the table.

1. What cost 16 cwt. of cheese, at *L.*1 18*s.* 8*d.* per cwt.

L.	*s.*	*d.*		*L.*	*s.*	*d.*	
1	18	8		1	18	9	
		4×4=16 the quan.					2×8=16 the quan.
7	14	8		3	17	4	
		4				8	
30	18	8 Answer.		30	18	8 Proof.	

2. 28 yards of broadcloth, at 19*s.* 4*d.* per yard. Ans. *L.*27 1*s.* 4*d.*
3. 35 firkins of butter, at 15*s.* 3½*d.* per firkin. Ans. *L.*26 15*s.* 2½*d.*
4. 42 cwt. of tallow, at *L.*1 14*s.* 6*d.* per cwt. Ans. *L.*72 9*s.*
5. 64 gallons of brandy, at 9*s.* 5*d.* per gallon. Ans. *L.*30 8*s.*
6. 96 months wages, at *L.*1 3*s.* 4*d.* per month. Ans. *L.*112.
7. 120 dozen of candles, at 5*s.* 9*d.* per dozen. Ans. *L.*34 10*s.*
8. 132 yards of cloth, at 2*s.* 4*d.* per yard. Ans. *L.*15 8*s.*
9. 144 reams of paper, at 13*s.* 4*d.* per ream. Ans. *L.*96.

Quantities not found in the Table.

1. What cost 17 ells of Holland, at 7*s.* 8½*d.* per ell.

s.	d.		s.	d.
7	8½		7	8½
4×4+1=17 the quan.			3×6—1=17 the quan.	

1	10	10		1	3	1½
		4				6
6	3	4		6	18	9
	7	8½+			7	8½—
6	11	0½ Ans.		6	11	0½ Proof.

2. 23 ells of holland, at 1*s.* 6½*d.* per ell. Ans. *L.* 1 15*s.* 5½*d.*
3. 46 bushels of wheat at 4*s.* 7¼*d.* per bush. Ans. *L.* 10 11*s.* 9½*d.*
4. 59 yards of tabby, at 7*s.* 10*d.* per yard. Ans. *L.* 23 2*s.* 2*d.*
5. 94 pair of silk stockings, at 12*s.* 2*d.* per pair. Ans. *L.* 57 3*s.* 8*d.*
6. *143 pounds of flax, at 1*s.* 5*d.* per lb. Ans. *L.* 10 2*s.* 7*d.*

EXAMPLES OF WEIGHTS AND MEASURES.

1. What will 100 dollars weigh, each 17*pwts.* 7*grs.*
Ans. 7*lb.* 2*oz.* 9*pwts.* 4*grs.*

2. In 6 bars of iron, each weighing, 3*qrs.* 17*lb.* how many cwt. Ans. 5*cwt.* 1*qr.* 18*lb.*

3. From Portsmouth to Exeter is 14 miles 2 furlongs or 14¼ miles. The Stage travels this distance 12 times in a week. I demand how many miles it goes in a year, or 52 weeks at that rate? Ans. 8892 miles.

4. Borrowed 15 rolls of cloth, each 17*yds.* 1*qr.* 3*na.* and paid 5 rolls, each 19*yds.* 3*qrs.* 1*na.* how much is due?
Ans. 162⅔ *yds.*

5. In 30 casks of brandy, each 10*gal.* 2*qt.* 1*pt.* how many gallons? Ans. 318 *gal.* 3*qt.*

6. If 1 square rod of land produce 3*pec.* 6*qts.* 1*pint* of corn what will one acre, or 160 square rods produce?
Ans. 152½ *bushels.*

7. If a printer can set 1 page in 2*ho.* 45*min.* 33*sec.* how many hours will it take him to set 108 pages?
Ans. 297*ho.* 59*min.* 24*sec.*

MULTIPLICATION OF THE FEDERAL MONEY.

This is performed the same as Simple Multiplication, which will make the work much easier than by lawful money, especially when the quantity exceeds 12, and cannot be found in the table.

*When the quantity is above 144, the answer may be more easily found by the rules of practice.

RULE.*—Multiply the price by the quantity, as before, and carry as in Simple Multiplication; the product will be the answer in the same name of the multiplicand or price which may be expressed in any larger name at pleasure, agreeably to the method exhibited in Addition of this money.

EXAMPLES.

1. What cost 8 hats, at 1D. 59c. per hat?

Price 159 cents.
8 the quantity.

12,72 Ans.
D.d.c.

2. What cost 12lb. of tea, at 4½d. per lb.?

Price 45 cents.
12 the quantity.

5,40 Ans.
D.d.c.

3. What cost 7 horses, at 4E. 3D. 7d. 8c. per horse?

Price 4378 cents.
7 the quantity.

306,46 Ans.
D.d.c.

4. What cost 17 barrels of cyder, at 95 cents per barrel? Ans. 16D. 1d. 5c.

5. 68 pounds of sugar, at 16½ cts. per lb. Ans. 11D.22c.

6. 156 dozen of buttons, at 4d. 8c. 7m. per doz. Ans. 7E. 5D. 9d. 7c. 2m.

7. 678 pounds of flour at 5½ cents per lb. Ans. 37D. 29c.

COMPOUND DIVISION.

COMPOUND DIVISION teaches to find how often one number is contained in another of different denominations.

RULE 1.—Place the numbers as in Simple Division.

2. Begin at the left hand, and divide each denomination by the divisor, setting the quotients under their respective dividends.

3. But if there be a remainder, after dividing any of the denominations except the least, find how many of the next lower denomination it is equal to, and add to it the number, if any, which was in this denomination before; then divide the sum as usual, and so on till the whole is finished.

The method of proof is the same as in Simple Division.

*By this rule any question may be answered very readily, where the price of one is given to find the value of any proposed number that is the price of one pound, yard, bushel, &c. &c. given to find the value of any number of pounds, &c. desired, which will render it unnecessary to say any thing in the rule of practice respecting this money.

Examples of Money.

(1)			(2)			(3)			(4)		
L.	s.	d.	L.	s.	d.	L.	s.	d.	L.	s.	d.
3)151	0	$10\frac{1}{2}$	4)7			5)100	19		6)11		
50	6	$11\frac{1}{2}$	1	15		20	3	$9\frac{1}{2}$(2)	1	16	8
		3		4				3			6
151	0	$10\frac{1}{2}$	proof			100	19	0			

5. Divide L.225 2s. 4d. by 2. Ans. L.112 11s. 2d.
6. Divide L.751 14s. $7\frac{1}{2}d.$ by 3. Ans. L.250 11s. $6\frac{1}{2}d.$
7. Divide L.821 17s. 8d. by 4. Ans. L.205 9s. 5d.
8. Divide L.2382 13s. $5\frac{1}{2}d.$ by 5. Ans. L.476 10s. $8\frac{1}{4}d.$
9. Divide L.28 2s. $1\frac{1}{2}d.$ by 6. Ans. L.4 13s. $8\frac{1}{4}d.$
10. Divide L.4 7s. by 7. Ans. 12s. $5\frac{1}{7}d.$
11. Divide L.1 17s. by 8. Ans. 4s. $7\frac{1}{2}d.$
12. Divide L.135 10s. 7d. by 9. Ans. L.15 1s. 2d.
13. Divide L.8 11s. by 10. Ans. 17s. $1\frac{2}{10}$ d.
14. Divide L.19 by 11. Ans. L.1 14s. $6\frac{1}{2}d.\frac{2}{11}$.
15. Divide L.1332 11s. $8\frac{1}{2}d.$ by 12. Ans. L.111 0s. $11\frac{1}{2}d.$

When the divisor exceeds 12, and can be found by the multiplication of small numbers, divide by them continually, as in Simple Division.

EXAMPLES.

1. What is cheese per cwt. if 16 cwt. cost L.30 18s. 8d.? Ans. L.1 18s. 8d.
2. If 20 cwt. of tobacco come to L.120 10s. what is it per cwt.? Ans. L.6 0s. 6d.
3. Divide L.57 3s. 7d. by 35. Ans. L.1 12s. 8d.
4. Divide L.85 6s. by 72. Ans. L.1 3s. $8\frac{1}{4}d.$

If the divisor cannot be found by the multiplication of small numbers divide by it after the manner of long division.

EXAMPLES.

1. Divide L.4 13s. 6d. by 17. Ans. 5s. 6d.
2. Divide L.23 15s. $7\frac{1}{4}d.$ by 37. Ans. 12s. $10\frac{1}{4}d.$
3. Divide L.199 3s. 10d. by 53. Ans. L.3 15s. 2d.

DIVISION OF THE FEDERAL MONEY.

64. RULE.—Divide as in Simple Division; the quotient or answer will be of the same name in which the dividend was expressed.

If there be a remainder when the dividend stands in any name higher than mills, cyphers may be annexed to the remainder, and the quotient continued to mills, if it will go so far.

EXAMPLES.

D.d.c.m.
1. Divide 7, 5 9 5 by 5
5)7595 mills.
1, 5 1 9 Ans.
D. d. c. m.

D.
2. Divide 733 by 8.
8)733000 mills.
91, 6 2 5 Ans.
D. d. c. m.

3. Divide 730 cents equally among 12 men.
12)7300 mills
$608\frac{4}{12}$ Ans.
d.c.m.

D. c.
4. Divide 144,66 by 113c.
113)14466(1, 2 8+Ans.
113 D. d. c.
316
226
906
904
2

5. Divide 100 dollars by 63
63)100(1587+Ans.
63 mills.
370
315
550
504
460
441
19

6. Divide 5078 dimes by 7689cts.
7689)50780(6 6 +Ans.
46134 c.m.
46460
46134
326

7. Divide 19D. by 29. Ans. 6d. 5c. 5m. $\frac{5}{29}$.
8. Divide 29D. by 19. Ans. 1D, 5d. 2c. 6m. $\frac{6}{19}$.
9. If 1000 eggs cost 10D. what is that per egg? Ans. 1c.
10. Divide 27D. 5d. 7c. 4m. by 17. Ans. 1D. 6d. 2c. 2m.
11. If 196 pounds of flour cost 6666 mills, what is it per lb.? Ans. 3c. $4\frac{2}{196}$m.
12. If 300 squares of glass cost 15D. what is it per square? Ans. 5cnts.
13. Divide 70D. among 5 men and 4 women, and give the men twice as much as the women.

5 men and 4 women.	Cents.	Cents.
Mult. by 2	14)70700(5050 one woman's share.	
	70	4 women.
10 shares.	70	202,00 women's shares.
Add 4 women's shares.	70	D.
14 the number of equal shares in the whole for a divisor.	0	D. c.
		50,50 one woman's share.
		2.
D.		
202 women's shares.		101,00 one man's share.
505 men's shares.		5 men.
Proof 707 Dol.		Dol. 505 men's shares.

14. Divide 147D. among 7 men and 7 women, and give the women three times as much as the men.

——— Ans. a man's share is 5¼D. and a woman's 15¾D.

15. Divide 556D. 85c. among 4 men 6 women, and 9 boys: give each man double to a woman, and each woman double to a boy.

Ans. 15D. 5c. a boy's share, 30D. 10c. a woman's, and 60 D. 20c. a man's.

EXAMPLES OF WEIGHTS AND MEASURES.

lb.	oz.	pwt.	gr.	Cwt.	qr.	lb.	oz.	dr.	mi.	fur.	po.
4)6	10	14	7	8)17	3	14	13	14	8)4	4	17

yds.	qr.	na.	tun.	hhd.	gal.	qt.	mo.	da.	hrs.	m.
9)76	3	1	12)17	1	60	1	11)14	5	17	17

REDUCTION.

REDUCTION is the method of bringing numbers from one name or denomination to another, so as still to retain the same value.

RULE 1.—When the reduction is from a greater name to a less, multiply the highest name or denomination by as many as make one of the next less, adding to the product the parts of the second name, and so on, through the denominations to the last, if the question require it.—This is called Reduction Descending.

2. When the reduction is from a less name to a greater, divide the given number by as many as make on of the next

superior denomination ; and this quotient again by as many as make one of the next following, and so on, through all the denominations to the highest ; and this last quotient, with the remainders will be the answer required.—This is called Reduction Ascending.

The method of proof is by reversing the question.

REDUCTION DESCENDING.

EXAMPLES OF MONEY.

In L.1465 14s. 5d. how many farthings?

L.	s.	d.		qrs.
1465	14	5		4)1407092
20				12)351773
29314				2|0)2931|4 5
12				L.1465 14 5 proof.
351773				
4				
1407092 qrs. Answer.				

2. In L.12 how many farthings? Ans. 11520
3. In L.46 how many shillings and pence? Ans. 920s. 11040d.
4. In L.7 14s. 6¼d. how many farthings? Ans. 7417
5. In L.50 9s. 9½d. how many half-pence? Ans. 24235
6. In L.160 15s. 6d. how many six-pences? Ans. 6431
7. In L.48 12s. 8d. how many groats?* Ans. 2908
8. In L.90 17s. 6d. how many two-pences? Ans. 11905
9. Reduce 120 six-pences into three-pences, pence and farthings. Ans. 240 three-pences 720d. 2880qrs.

REDUCTION ASCENDING.

EXAMPLES.

1. In 11040d. how many shillings and pounds? Ans. 920s. 46L.

d.	L.
12)11040	46
2|0)92|0	20
L.46 Ans.	920
	12
	11040d. proof.

2. In 1680d. how many pounds? Ans. L.7.
3. In 7417qrs. how many pounds? Ans. L.7 14s. 6¼d.

* A groat is equal to four pence.

4. In 44871 qrs. how many pounds? Ans. £.46 14s. 9¾.
5. Reduce 24235 half-pence into pounds. Ans. £.50 9s 9½d.
6. In 2918 groats how many pounds? Ans. £.48 12s. 8d.
7. In 5760 qrs. how many crowns at 6s. 8d. each? Ans. 18d.
8. In 9030 half-pence how many dollars at 6s. each?
Ans. 62 Dol. and 5s. 1d. over.

REDUCTION ASCENDING AND DESCENDING.

EXAMPLES.

1. In 12180 three-pences how many shillings, pence and groats? Ans. 3045s. 36540d. 9135 groats.

2. Four men brought each £.17 10s. value in gold into the mint to be coined into guineas, 21s. each, how many must they have? Ans. 66 and 14s. over.

3. In 426 French crowns, each 4s. 6½d. how many pounds? Ans. £.96 3s. 10½d.

4. A Victualler gave his servant £.3 9s. 6d. to go and buy provision. He went and bought sheep for 6s. 8d. each, turkies for 2s. 9½d. geese for 1s. 6d. and larks for 7½d. and an equal number of each. What was that number? Ans. 6.

REDUCTION OF THE FEDERAL MONEY.

Reduction of the Federal Money has been already shown in Addition, so far as it is applicable to the reduction of lawful money, viz. expressing large names in small ones, as dollars expressed in dimes, cents or mills, which is applicable to pounds expressed in shillings, pence or farthings.

What I shall attempt to show in this place, is the method of reducing lawful money to federal money, and federal money to lawful money.

1. *To reduce lawful money to federal money, where the dollar is rated at 6 shillings—*

RULE 1.—If the sum be pounds only, annex a cypher and divide by 3, and if there be any remainder it will always be ⅓ or ⅔ of another dollar.

EXAMPLES.

1. Reduce £.17 to dollars.

3)170

56D. and ⅔, or 4 shillings, equal to 56D. 66c. Ans.

2. Reduce £.100 to dollars. Ans. 333⅓D.

3. Reduce £.45 to dollars. Ans. 150D.

RULE 2.—If the sum be pounds and shillings, divide the pounds by 3, and the shillings by 6, calling all the quotient dollars.

EXAMPLES.

1. Reduce L.5 14s. to dollars.

3 & 6) 5 14 Here I say I can have once 3 in 5 and 2 over which are L.2=40s. and the 14s. added to the 40s.=54s. which divided by 6, gives 9 in the quotient.

Ans. 19 D.

2. Express L.30 18s. in dollars. Ans. 103D.

3. Reduce L.85 16s. to dollars. Ans. 286D.

NOTE.—If there be a remainder of shillings after dividing by 6, or if there be pence and farthings given they may be expressed in cents and mills and annexed to the dollars in the answer.

EXAMPLES.

1. Reduce L.11 10s 9d. to dollars and cents

3 & 6) 11 10 9

38D. and 2s. 9d. over, equal to 38D. 45c. 8m. Ans.

2. Reduce L.27 8s. 6½d. to federal money. Ans. 91D. 42c. 8m

3. Express L.187 15s. 4½d. in dollars and cents.

Ans. 625D. 89c. 5m.

4. Reduce L.211 19s. 10d. to dollars and cents.

Ans. 706D. 63c. 8m

5. Reduce L.17 5s. 8½d. to federal money. Ans. 57D. 61c. 8m.

6. Reduce L.1001 1s. 1d. to dollars and cents.

Ans. 3336D. 84. 7m

The following table will be useful to the beginner in performing the foregoing examples.

TABLE, *of Lawful money reduced to Federal Money, from two farthings to one dollar, where the dollar is rated at 6s.— which will answer for N.Hampshire, Massachusetts, R.Island, Connecticut and Virginia.*

L. M.		F. M.			L. M.		F. M.		
d.	*qrs.*	*c.*	*m.*		*s.*	*d.* *qrs.*	*c.*	*m.*	
0	2	0	6	17—18*ths.*		7 2	10	4	3—18*ths.*
1	0	1	3	16—18*ths.*		8 0	11	1	2—18*ths.*
1	2	2	0	15—18*ths.*		8 2	11	8	1—18*ths.*
2	0	2	7	14—18*ths.*		9 0	12	5	
2	2	3	4	13—18*ths.*		9 2	13	1	17—18*ths.*
3	0	4	1	12—18*ths.*		10 0	13	8	16—18*ths.*
3	2	4	8	11—18*ths.*		10 2	14	5	15—18*ths.*
4	0	5	5	10—18*ths.*		11 0	15	2	14—18*ths.*
4	2	6	2	9—18*ths.*		11 2	15	9	13—18*ths.*
5	0	6	9	8—18*ths.*	1	— —	16	6	12—18*ths.*
5	2	7	6	7—18*ths.*	2	— —	33	3	6—18*ths.*
6	0	8	3	6—18*ths.*	3	— —	50	0	—
6	2	9	0	5—18*ths.*	4	— —	66	6	12—18*ths.*
7	0	9	7	4—18*ths.*	5	— —	83	3	6—18*ths.*
					6	— —	100		

I. To reduce Federal money to Lawful Money, where the dollar is rated at six shillings.—

RULE.—Multiply the sum expressed in mills, by 72, and cut off three figures from the right hand of the product, the figures on the left hand will be the answer in pence, and the three figures cut off on the right, must be multiplied by 4, and from the right hand of the product cut off three figures as before, and the figure on the left will be farthings.

EXAMPLES.

1. Reduce 76D. 9c. to lawful money.

The sum expressed in mills is 76090 mills.

```
        72
     ------
     15218
    53263
    -------
  12)5478|480        480
    -------            4
  2|0)45|6  6        ----
    -------          1|920
```

Ans. £. 22 16 6¼

2. Reduce 1c. to lawful money.

```
  10 mills.
  72
  ---
  720
    4
  ----
qrs. 2)880
```

Ans. 2qrs. $\frac{88}{125}$ almost 3qrs.

3. Reduce 7 dimes to lawful money.

```
        700 mills.
         72
       --------
     12)50|400
       --            4
 4s. 2½d.         ----
                  1|600
```

Ans. 4s. 2d. 1 $\frac{6}{10}$ qrs.

A TABLE *containing cents from 1 to 100, reduced to shillings pence and farthings, where the dollar is rated at 6 shillings.*

F. M.	L. M.				F. M.			L. M.			
c.	s.	d.	qrs.		d.	or	c.	s.	d.	qrs.	
1	0	0	2	22—25ths.	1	or	10	0	7	0	20—25ths.
2	0	1	1	19—25ths.	2	or	20	1	2	1	15—25ths.
3	0	2	0	16—25ths.	3	or	30	1	9	2	10—25ths.
4	0	2	3	13—25ths.	4	or	40	2	4	3	5—25ths.
5	0	3	2	10—25ths.	5	or	50	3	0	0	
6	0	4	1	7—25ths.	6	or	60	3	7	0	20—25ths.
7	0	5	0	4—25ths.	7	or	70	4	2	1	15—25ths.
8	0	5	3	1—25ths.	8	or	80	4	9	2	10—25ths.
9	0	6	1	23—25ths.	9	or	90	5	4	3	5—25ths.
10	0	7	0	20—25ths.	10	or	100	6	0	0	

The use of this table is for speedily finding the value of cents in L. money.

EXAMPLE.

What is the value of 23 cents in lawful money?

Cast your eye in the column of federal money at 3c. against which, in the column of lawful money, you will find 2*d*. $0\frac{1}{5}$ *gr*. Then cast your eye at 2d. or 20c. against which is 1*s*. 2*d*. $1\frac{1}{2}$ *gr*. which added to 2*d*. $0\frac{1}{5}$ makes 1*s*. 4*d*. $2\frac{1}{5}$ *gr*.; or which is sufficiently near, 1*s*. $2\frac{1}{4}$*d*. added to 2*d*. makes 1*s*. $4\frac{1}{4}$*d*.—the fractions after the farthings, not worth reckoning.

TROY WEIGHT.

EXAMPLES.

1. 47lb. 10 oz. how many grains? Ans. 275520.
2. In 47128 gr. how many pounds? Ans. 8lb. 2oz. 3pwts. 16gr.
3. In 10lb. of silver, how many spoons, each 5 oz. 10 pwts.? Ans. 21, 90 pwts. over.
4. In 4560 grains of gold, how many tea-spoons, each half an ounce? Ans. 19
5. A Goldsmith having 3 ingots of silver, each weighing 27 oz. was minded to make them into spoons of 2 oz. cups of 5 oz. salts of 1 oz. and snuff boxes of 2 oz. and to have an equal number of each. What was that number? Ans. 8, 1 oz. over.

AVOIRDUPOIS WEIGHT.

EXAMPLES.

1. In 7 cwt. 3qrs. 10lb. how many drachms? Ans. 224768.
2. In 3 tons of iron how many pounds? Ans. 6720.
3. In 470 parcels of sugar, each 26lb. how many cwt.? Ans. 109cwt. 0qr. 12lb.
4. In 8 hhds. of tobacco, each weighing $7\frac{1}{2}$cwt. how many lb? Ans. 6720.
5. In 36 cocks of hay, each 88lb. how many tons? Ans. 1 T. 8cwt. 1qr. 4lb.

LONG MEASURE.

EXAMPLES.

1. In 70 miles how many poles? Ans. 22400
2. In 4000 inches how many yards? Ans. 111yds. 4 in.
3. In 4 leagues how many yards? Ans. 21120.
4. How many barley corns in a mile? Ans. 190080.
5. How many times does a wheel turn which is 18 feet 6 inches round, in going 150 miles? Ans. 42810 times, and 180 inches over.
6. How many barley corns will reach round the world, which is 360 degrees, each degree $69\frac{1}{2}$ miles? Ans. 4755801600.
7. In 700 yards how many rods? Ans. 127 rods, $4\frac{1}{2}$ ft.

CLOTH MEASURE.

EXAMPLES.

1. In 14 yards how many nails? Ans. 224.
2. In 17 yds. 1 qr. 2 na. how many nails? Ans. 278.
3. In 47128 nails how many pieces, each 12 yards? Ans. 245 piec. 5yds. 2qrs.
4. In 17 pieces of cloth, each 27 flemish ells, how many yards? Ans. 344yds. 1qr.
5. In 7000 nails of holland how many English ells? Ans 350.

LIQUID MEASURE.

EXAMPLES.

1. In 17 gallons how many pints? Ans. 136.
2. In 10 barrels of beer how many quarts? Ans. 1440.
3. In 4 barrels of ale how many gallons? Ans. 128.
4. In 72 hogsheads of beer how many barrels? Ans. 108.
5. In 4 tuns of oil how many quarts? Ans. 4032.
6. If a Vinter be desirous to draw off a pipe of canary into bottles, containing pints, quarts, and two quarts, and of each an equal number, how many must he have? Ans. 144 of each.

DRY MEASURE.

EXAMPLES.

1. In 40 quarters of wheat how many bushels? Ans. 320.
2. In 1280 pecks how many quarters? Ans. 40.

TIME.

EXAMPLES.

1. In 121812 seconds how many hours? Ans. 33h. 50.m 12s.
2. In 41 weeks how many minutes? Ans. 413280.
3. How many seconds in a year, allowing it to be 365 days and 6 hours? Ans. 31557600.
4. From March 2, to November 19, following (inclusive) how many days? Ans. 263.

RULE OF THREE DIRECT.

The Rule of Three Direct teaches, by having three numbers given to find the fourth that shall have the same proportion to the third, as the second has to the first.

Rule 1.—State the question; that is, place the numbers so, that the first and third be of the same name, and the second the same as the number required.

2. Bring the first and third numbers into the same denomination, and the second into the lowest name mentioned.

11. Bought a firkin of butter, containing 56lb. for 18s. 8d. what is that per lb? Ans. 4d.

12. Sold 3cwt. of tobacco at 25c. per lb. what came the whole to? Ans. 84D.

13. If 1lb. of sugar cost 12½c. what cost 17cwt. 2qrs.? Ans. 245D.

14. Bought 3 casks of raisins, each weighing 2cwt. 2qrs. 25lb. what will they come to at L.2 1s. 8d. per cwt? Ans. L.17 0s. 4¾d.

15. If 1 oz. of silver cost 9d. 1c. 5m. what is the price of a tankard, which weighs 1lb. 10 oz. 10 pwts. 4 gr. Ans. 20D. 5d. 9c. 5m. $\frac{6}{48}$.

16. If 1 lb. of tobacco cost 15d. what cost 15cwt. 1qr. 19lb? Ans. L.107 18s. 9d.

17. If a yard of cloth be worth 14s. what cost 5 pieces, each 19 yards? Ans. L.66 10s.

18. If a bushel of coal cost 10d. how many chaldrons for L.100? Ans. 66 chal. 24 bu.

19. How many quarters of corn for L.42, at 4s. per bushel? Ans. 26qrs. 2bu.

20. If a man's yearly income be 1000D. 1d. what is it per day? Ans. 2D. 7d. 4c.

21. If a man spend 7d. a day, how much is that in a year? Ans. L.10 12s. 11d.

22. If a pint of wine cost 10d. what cost 3hhds? Ans. L.63.

23. Bought 12 pieces of cloth, each 12yds. at 1D. 75c. per yard, what came they to? Ans. 252D.

24. How much must I pay for the carriage of 10½cwt. at the rate of 1½d. per lb? Ans. L.7 7s.

25. If 6 horses eat up 21 bushels of oats in 1 week, how many bushels will serve 20 horses the same time? Ans. 70bu.

26. If a family of 10 persons spend 3 bushels of corn in a month, how many bushels will serve them when there are 30 in a family? Ans. 9 bu.

27. A merchant hath owing to him L.1000 and his debtor doth agree to pay him for every pound 12s. 6d. how much must he pay in all? Ans. L.625.

28. A man bought a piece of cloth for 55D. at 2½D. per yard, how many yards did it contain? Ans. 22 yards.

29. What cost 49392 case knives, at 8d. 3c. 3m. per dozen? Ans. 342E. 8D. 6d. 2c. 8m.

30. A gentleman has an estate of L.245 10s. a year, how much may he spend per day, to lay up L.63 at the year's end? Ans. 10s.

31. At 6s. 8d. per week how many months board may I have for L.50? Ans. 37 months, 2 weeks.

32. What is the value of 2qrs. 1n. of velvet at 19s. $8\frac{1}{2}d.$ per English ell? Ans. 8s. $10\frac{1}{2}d.$

33. What is the tax upon L.745 14s. 8d. at 3s. 6d. in the pound? Ans. L.130 10s $0\frac{1}{4}d.$ $\frac{48}{240}$.

34. If $\frac{3}{4}$ of a yard of velvet cost 1D. 25c. how many yards can I buy for 45D.? Ans. 27 yards.

35. If 1 English ell 2qrs, cost 4s. 7d. what will $39\frac{1}{2}$ yds cost? Ans. L.5 3s. $5\frac{1}{4}d.$

36. Bought 4 bales of cloth, each containing 6 pieces and each piece 27 yds. at L.16.4s. per piece, what is the value of the whole and the rate per yd? Ans. L.388 16s. at 12s. per yd.

37. Suppose a gentleman's income be L.525 a year, and he spend 19s. 7d. per day, how much will he have saved at the year's end? Ans. L.167 12s. 1d.

38. At 13s. $2\frac{1}{2}d$ per yard, what is the value of a piece of cloth containing $52\frac{3}{4}$ English ells? Ans. L.43 8s. $5\frac{1}{4}d.$

39. How many English ells of Holland may be bought for L.105 at 3s. $9\frac{1}{2}d.$ per yard? Ans. 191 ells.

40. If I buy 15 yards of cloth for $88\frac{1}{2}$D. how many flemish ells can I buy for 802D. 65c, at the same rate?

Ans. 416 flem.ells. 2qrs. 3na. $\frac{2}{3}\frac{2}{8}\frac{5}{5}$.

41. Admit a tax of L.39 is laid on a town for building a bridge, and the value of the town rent is L.900 per annum what must a man pay towards it whose income is worth L.100 per annum? Ans. L.4 6s. 8d.

42. A person breaking, owes in all L.1490 5s. 10d. and has in money, goods and irrecoverable debts, L.784 17s. 4d. if these things be delivered to his creditors, what will they get on a pound? Ans. 10s $6\frac{1}{4}d.$

43. How many grains of pure gold are there in the federal eagle, which is to contain 270gr. of standard gold, one twelfth part being alloy? Ans. $247\frac{1}{2}$gr. *see Table.*

44. Bought 3 tuns of oil for L.151 14s. 85 gallons of which being damaged, I desire to know how I may sell the remainder per gallon, so as neither to gain nor lose by the bargain? Ans. 4s. $6\frac{1}{4}d.$ $\frac{25}{671}$.

45. What quantity of water must I add to a pipe of mountain wine, value L.33 to reduce the first cost to 4s. 6d. per gallon? Ans. $20\frac{2}{3}$gal.

46. A merchant in London buys 64 tuns of French wine for L.460, the freight thereof cost L.220, loading and unloading L.10 custom and other charges L.23, and he must gain L.250 by the bargain; a gentleman comes and demands the price of 24 tuns, what must he give? Ans. L.361 2s. 6d.

47. If 15 ells of stuff $\frac{3}{4}$ wide cost L.1 17s. 6d. what will 40 ells of the same stuff cost, being yard wide? Ans. L.6 13s. 4d.

Form of an account between a Farmer and Blacksmith.

The Farmer's account will stand with the debt on the left hand page of his book, and the credit on the right, thus,

1797.	MR. JOHN IRON, DR.	D.	C.	M.
Feb. 10.	To 20 bushels of corn, at 75c. per bush.	15	00	
24.	To 55 bushels of potatoes, at 20 c. per bushel, and 1 ton of hay $17\frac{1}{2}$D.	28	50	
March 11.	To 96lb. beef, at 6c. per lb. and $5\frac{1}{4}$ cord wood, at $4\frac{1}{2}$D. per cord,	28	38	5
April 10.	To 5 days work of myself and 4 oxen, at $1\frac{4}{5}$D. per day,	7	20	
June 4.	To 120lb. of flax, at $12\frac{1}{2}$c. per lb. and 40lb. of wool, at 33c. per lb.	28	30	
20.	To hauling 15 cord of wood, at 66c.	59	85	
Sept. 10.	To 15bbls. cider, at 3D. 33c. per bbl.			
Oct. 24.	To 27cwt. of hay, at $8\frac{1}{2}$D. per ton, and 2bbls. perry, at $9\frac{3}{4}$D.	21	22	5
Dec. 9.	To 145lb. of pork, at 6D. per cwt. and 43lb. beef, at $5\frac{1}{4}$D. per cwt.	9	78	3
1798. Jan. 10.	To 46lb. butter, at 166m. per lb. and 20lb. cheese, at 8c. per lb.	9	23	6
	Total,	207	67	9

The Blacksmith's account will stand with the debt on the left hand page of his book, and the credit, on the right, thus,

1797.	MR. PETER HARDY, DR.	D.	C.
Feb. 14	To shoeing your horse, $1\frac{1}{2}$D. & 4 hooks, 83c.	2	33

And so on, precisely agreeing with the Farmer's credit, the amount of which is 65D. 64c. 5m.

After settlement, Mr. Hardy will begin his account, thus,

1798.	MR. JOHN IRON, DR.	D.	C.
April 2.	To balance due on account (see reck'ing)	142	6 4m.

NOTE.—*If the parties are not going to trade any farther in account, the reckoning may be written thus,*

We the subscribers have balanced our accounts by a Note of Hand for one hundred and forty-two dollars six cents and four mills in favor of Peter Hardy.—Witness our hands.

JOHN IRON,
PETER HARDY.

April 2, 1798.

1797.	MR. JOHN IRON, Cr.	D.	C.	M.
Feb. 14.	By shoeing my horse $1\frac{1}{2}$D. & 4 hooks, 83c.	2	33	
March 1.	By 5 hundred nails, at 66c 6m. per H.	3	33	
May 10.	By 50 spikes, at $6\frac{1}{2}$c. a piece, & 1 axe $1\frac{1}{4}$D	4	50	
27	By a set of cart hoops $5\frac{1}{4}$D. and 15 hoes, at $1\frac{1}{4}$D. a piece.	24	25	
July 4.	By a pair of plough irons, weighing 43lb. at $12\frac{1}{2}$c. per lb.	5	37	5
29	By a scythe, $1\frac{1}{2}$D. and mending chains 1 D. 33c.	2	83	
Sept. 9	By an iron shovel, $1\frac{1}{2}$D. 100 deck nails, at 11c. a piece.	12	60	
1798. Jan. 10	By shoeing 6 cattle, 3D. and ironing a sleigh $7\frac{1}{2}$D.	10	50	
	Total,	65	61	5

1797	MR. PETER HARDY, Cr.	D.	C.	M.
Feb. 10	By twenty bushels of corn, at 75c. pr. bus.	15	00	0

And so on, precisely agreeing with the Farmer's debt, the amount of which is 207D. 67c. 9m.

The above account may be settled thus, if the parties are going to continue in Trade.

	D.	C.	M.
Mr. Hardy's account is	207	67	9
Mr. Iron's do.	65	61	5
Due to Mr. Hardy,	142	06	4

NOTE.—*Let the following reckoning be written in both books, and let each subscribe his name in his own book last.*

This day we the subscribers have settled our accounts to this date, and find due to Peter Hardy, one hundred and forty-two dollars six cents and four mills to balance his account. Witness our hand. PETER HARDY,

Stratham, April 2, 1798. JOHN IRON.

After settlement, Mr. IRON will begin his credit thus

1798.	MR. PETER HARDY, Cr.	D.	C.	M.
April 2	By balance due on his account (see the reckoning) ——	142	06	4

For value received I promise to pay Peter Hardy, or his order, one hundred and forty-two dollars, six cents and four mills, on demand with interest 'till paid.—Witness my hand.

142D. 06c. 4m. JOHN IRON.

Stratham, April, 2, 1798.

RULE OF THREE INVERSE.

THE RULE OF THREE INVERSE teaches by having three numbers given to find a fourth, that shall have the same proportion to the second as the first has to the third.

If a greater number require a greater, or a less require a less, the question belongs to the Rule of Three Direct. But if a greater number require a less, or a less require a greater, it belongs to the Rule of Three Inverse.

RULE 1.—State and reduce the terms as in the Rule of Three Direct.

2. Multiply the first and second terms together, and divide their product by the third, the quotient is the answer.

The method of proof is by inverting the question.

EXAMPLES.

1. If 48 men can build a wall in 24 days, how many men can do the same in 192 days? Ans. 6 men.

If a traveller perform a journey in three days, when the days are 16 hours long, how many days of 12 hours long will it require to perform the same journey? Ans. 4 days.

3. How many yards of matting, which is half yard wide, will cover the floor of a room 18 feet wide and 30 feet long? Ans. 120 yards.

4. If 28*s.* will pay for the carriage of an cwt. 150 miles, how far may 6 cwt. be carried for the same money? Ans. 25 miles.

5. If when the price of a bushel of wheat is 6*s.* 3*d.* the penny loaf weigh 90 oz. what ought it to weigh when the wheat is at 9*s.* 4½*d.* per bushel? Ans. 60 oz.

6. Suppose 800 soldiers were placed in a garrison and their provisions were computed sufficient for 2 months; how many soldiers must depart, that the provisions may serve them for five months? Ans. 480 men.

7. What must the length be to make a square foot, when the breadth is 4½ inches? Ans. 32 inches.

8. How many yards of stuff 3 qrs. broad will line a cloak that is 5½ yards in length and 1¼ broad? Ans. 9 yds. 0⅔qrs.

9. If 30 men can perform a piece of work in 11 days, how many men will accomplish another piece of work four times as large, in a fifth part of the time? Ans. 600 men.

10. What must be the length to contain an acre of land, when the breadth is 15 rods? Ans. 10 rods, 3yds. 2ft.

11. A piece of tapestry is 3 ells flemish wide, and 4 ells flemish long, and it is required to be lined with something that is but 3qrs. of a yard wide, how many yards must there be to complete the lining? Ans. 9 yards.

PRACTICE.

PRACTICE is the short way of finding the value of any quantity of goods, by the given price of one integer.

The method of proof is by the Rule of Three Direct, or by varying the parts.

An aliquot part of any number, is such a part of it, as being taken a certain number of times, doth exactly make that number.

TABLES.

d.		s. d.		lb.	
6 is	$\frac{1}{2}$ of a shilling.	10 0	$\frac{1}{2}$ of a £.	56 is	$\frac{1}{2}$ of a cwt.
4	$\frac{1}{3}$	6 8	$\frac{1}{3}$	28	$\frac{1}{4}$
3	$\frac{1}{4}$	5 0	$\frac{1}{4}$	16	$\frac{1}{7}$
2	$\frac{1}{6}$	4 0	$\frac{1}{5}$	14	$\frac{1}{8}$
$1\frac{1}{2}$	$\frac{1}{8}$	3 4	$\frac{1}{6}$	8	$\frac{1}{14}$
1	$\frac{1}{12}$	2 6	$\frac{1}{8}$	7	$\frac{1}{16}$
		2 0	$\frac{1}{10}$		
		1 8	$\frac{1}{12}$		

CASE I.

When the price is less than a penny.

RULE.—Find the aliquot parts of that price contained in a penny, which must be divisors to the given sum, or take parts of parts, instead of parts of the whole price.

NOTE.—What remains, after dividing by any number, is always of the same name with the dividend.

EXAMPLES.

What is the value of 4712lb. of chalk, at $\frac{3}{4}d.$ per lb.

$\frac{1}{2}$	$\frac{1}{2}$	4712	*lb.* *d.* *lb.*	7612 at $\frac{1}{4}d.$
			4712—3534—1	
$\frac{1}{4}$	$\frac{1}{2}$	2356	4	Ans. 7 18*s.* 7*d.*
		1178		
			4712)14136(3qrs. proof.	6812 at $\frac{1}{2}d.$
	12	3534	14136	
				Ans. £.14 3*s.* 10*d.*
	2|0	29|4 6		
				9180 at $\frac{3}{4}d.$
		14 14 6 Ans.		
				A 28 13*s.* 9*d.*

CASE II.

When the price is an aliquot part of a shilling.

RULE.—Divide the given number by the aliquot part, the quotient is the answer in shillings, which reduce into pounds as before.

EXAMPLES.

7612 at 1*d.* Ans. 31*l.* 14*s.* 4*d.* | 5275 at 2*d.* Ans. 43*l.* 19*s.* 2*d.*

6771 at 4*d*. Ans. 112*l*. 17*s*.
1776 at 3*d*. Ans. 22*l*. 4*s*.
4121 at $1\frac{1}{2}$*d*. Ans. 25*l*. 15*s*. $1\frac{1}{2}$*d*.
899 at 6*d*. Ans. 22*l*. 9*s*. 6*d*.

CASE III.

When the price is pence and farthings, and is no aliquot part of a shilling.

RULE.—Divide the given number by some aliquot part and then consider, what part of the said aliquot part the rest is, and divide the quotient thereby, the last quotient, together with the former, will be the answer in shillings, which reduce as before.

EXAMPLES.

4	$\frac{1}{3}$	6100 at $5\frac{3}{4}$*d*.
1	$\frac{1}{4}$	2033 4
$\frac{1}{2}$	$\frac{1}{8}$	508 4
$\frac{1}{4}$	$\frac{1}{2}$	254 2
		127 1
	2|0	292|2 11
		146 2 11 Ans.

8612 at $1\frac{1}{4}$*d*. Ans. 44*l*. 17*s*. 1*d*.
1061 at $1\frac{3}{4}$*d*. Ans. 13*l*. 11*s*. $4\frac{3}{4}$*d*.
6181 at $2\frac{1}{4}$*d*. Ans. 57*l*. 18*s*. $11\frac{1}{4}$*d*.
1218 at $2\frac{1}{2}$*d*. Ans. 12*l*. 13*s*. 9*d*.
8012 at $2\frac{3}{4}$*d*. Ans. 91*l*. 16*s*. 1*d*.
6128 at $3\frac{1}{4}$*d*. Ans. 82*l*. 19*s*. 8*d*.
6180 at $3\frac{1}{2}$*d*. Ans. 90*l*. 2*s*. 6*d*.
7812 at $3\frac{3}{4}$*d*. Ans. 122*l*. 1*s*. 3*d*.
7000 at $4\frac{1}{4}$*d*. Ans. 123*l*. 19*s*. 2*d*.
6001 at $4\frac{1}{2}$*d*. Ans. 112*l*. 10*s*. $4\frac{1}{2}$*d*.
7121 at $4\frac{3}{4}$*d*. Ans. 140*l*. 18*s*. $8\frac{3}{4}$*d*.
7181 at 5*d*. Ans. 149*l*. 12*s*. 1*d*.
8121 at $5\frac{1}{4}$*d*. Ans. 177*l*. 12*s*. $11\frac{1}{4}$*d*.

6128 at $5\frac{1}{2}$*d*. Ans. 140*l*. 8*s*. 8*d*.
7610 at $6\frac{1}{4}$*d*. Ans. 198*l*. 3*s*. $6\frac{1}{2}$*d*.
1218 at $6\frac{1}{2}$*d*. Ans. 32*l*. 19*s*. 9*d*.
6000 at $6\frac{3}{4}$*d*. Ans. 168*l*. 15*s*.
7100 at 7*d*. Ans. 207*l*. 2*s*. 3*d*.
1001 at $7\frac{1}{4}$*d*. Ans. 30*l*. 4*s*. $9\frac{1}{4}$*d*.
4100 at $7\frac{1}{2}$*d*. Ans. 128*l*. 2*s*. 6*d*.
6120 at $7\frac{3}{4}$*d*. Ans. 197*l*. 12*s*. 6*d*.
7100 at 8*d*. Ans. 236*l*. 13*s*. 4*d*.
6100 at $8\frac{1}{4}$*d*. Ans. 209*l*. 13*s*. 9*d*.
8000 at $8\frac{1}{2}$*d*. Ans. 283*l*. 6*s*. 8*d*.
6000 at $8\frac{3}{4}$*d*. Ans. 218*l*. 15*s*.
9000 at 9*d*. Ans. 337*l*. 10*s*.
4121 at $9\frac{1}{4}$*d*. Ans. 158*l*. 16*s*. $7\frac{1}{4}$*d*.
6100 at $9\frac{1}{2}$*d*. Ans. 241*l*. 9*s*. 2*d*.
5918 at $9\frac{3}{4}$*d*. Ans. 240*l*. 8*s*. $4\frac{1}{2}$*d*.
8121 at 10*d*. Ans. 338. 7*s*. 6*d*.
6712 at $10\frac{1}{4}$*d*. Ans. 286*l*. 13*s*. 2*d*.
1002 at $10\frac{1}{2}$*d*. Ans. 43*l*. 16*s*. 9*d*.
4680 at $10\frac{3}{4}$*d*. Ans. 209*l*. 12*s*. 6*d*.
1260 at 11*d*. Ans. 57*l*. 15*s*.
6121 at $11\frac{1}{4}$*d*. Ans. 286*l*. 18*s*. $5\frac{1}{4}$*d*.
1234 at $11\frac{1}{2}$*d*. Ans. 59*l*. 2*s*. 7*d*.
2345 at $11\frac{3}{4}$*d*. Ans. 114*l*. 16*s*. $1\frac{3}{4}$*d*.

CASE IV.

When the price is more than one shilling, but less than two shillings.

RULE.—Let the part or parts be taken only with so much of the price as is more than one shilling, and let the given quantity stand for shillings, which must be added with the rest.

EXAMPLES.

$\frac{1}{4}$	486 at $12\frac{1}{4}d.$	
12	$121\frac{1}{2}$	
	10 1	
2|0	49|6	
	24 16 $1\frac{1}{2}$ Ans.	

6121 at 13*d.*	Ans. 331*l.* 11*s.* 1*d.*
1281 at $13\frac{1}{4}d.$	Ans. 70*l.* 14*s.* $5\frac{1}{4}d.$
1210 at $13\frac{3}{4}d.$	Ans. 69*l.* 6*s.* $5\frac{1}{2}d.$
6120 at $14\frac{1}{2}d.$	Ans. 369*l.* 15*s.*
1612 at $15\frac{1}{4}d.$	Ans. 102*l.* 8*s.* 7*d.*
7612 at $15\frac{3}{4}d.$	Ans. 499*l.* 10*s.* 9*d.*
4128 at 17*d.*	Ans. 292*l.* 8*s.*
2340 at $17\frac{1}{2}d.$	Ans. 170*l.* 12*s.* 6*d.*
5670 at $18\frac{1}{4}d.$	Ans. 431*l.* 3*s.* $1\frac{1}{2}d.$
8900 at 19*d.*	Ans. 704*l.* 11*s.* 8*d.*
9876 at $19\frac{1}{2}d.$	Ans. 802*l.* 8*s.* 6*d.*
7120 at $20\frac{1}{4}d.$	Ans. 600*l.* 15*s.*
9990 at $23\frac{3}{4}d.$	Ans. 988*l.* 11*s.* $10\frac{1}{2}d.$

486 at $12\frac{1}{2}d.$ Ans. 25*l.* 6*s.* 3*d.*

1216 at $12\frac{3}{4}d.$ Ans. 64*l.* 12*s.*

CASE V.

When the price is any number of shillings under twenty.

RULE 1.—When the price is an even number, multiply the given number by $\frac{1}{2}$ of it, doubling the first figure on the right hand, and the rest is pounds.

2. When the price is an odd number, find for the greatest even number as before, to which add $\frac{1}{20}$ of the given number for the odd shillings, and the sum is the answer.

EXAMPLES.

2756 at 6*s.*	Ans. 836*l.* 16*s.*	5271 at 14*s.*	Ans. 3689*l.* 14*s.*
2643 at 2*s.*	Ans. 264*l.* 6*s.*	3142 at 17*s.*	Ans. 2670*l.* 14*s.*
3271 at 5*s.*	Ans. 817*l.* 15*s.*	264 at 19*s.*	Ans. 250*l.* 16*s.*
827 at 8*s.*	Ans. 330*l.* 16*s.*	180 at 10*s.*	Ans. 9*l.*
372 at 11*s.*	Ans. 204*l.* 12*s.*		

CASE VI.

When the price is shillings and pence, which make some aliquot part of a pound.

RULE.—Divide the given quantity by the aliquot part, and the quotient is the answer in pounds.

EXAMPLES.

96 at 1*s.* 8*d.*	Ans. 8*l.*	69 at 3*s.* 4*d.*	Ans. 11*l.* 10*s.*
21 at 2*s.* 6*d.*	Ans. 2*l.* 12*s.* 6*d.*	12 at 6*s.* 8*d.*	Ans. 4*l.*

CASE VII.

When the price is shillings and pence, which make no aliquot part of a pound, and if farthings be given with the pence.

RULE.—Multiply the given quantity by the shillings, and take parts with the rest, and add them together; the sum will be the answer in shillings.

EXAMPLES.

3	$\frac{1}{4}$	126 at 9s. 3d.
		9
		1134
		31 6
	2|0	116|5 6
		58 5 6 Ans

86 at 6s. 10d. Ans. 29l. 13s. 8d.
10 at 12s. 4d. Ans. 6l. 3s. 4d.
30 at 4s. 9d. Ans. 7l. 2s. 6d.
73 at 7s. 6d. Ans. 27l. 7s. 6d.
70 at 7s. 4$\frac{3}{4}$d. Ans. 25l. 17s. 8$\frac{1}{2}$d.
55 at 4s. 8$\frac{1}{2}$d. Ans. 12l. 18s. 1$\frac{1}{2}$d.
77 at 10s. 6$\frac{1}{4}$d. Ans. 40l. 10s. 1$\frac{1}{4}$d.
12 at 13s. 10$\frac{1}{2}$d. Ans. 8l. 6s. 6d.
17 at 17s. 4$\frac{1}{4}$d. Ans. 14l. 15s. 0$\frac{1}{4}$d.
46 at 7s. 3$\frac{3}{4}$d. Ans. 16l. 16s. 4$\frac{1}{2}$d.

CASE VIII.

When the price is pounds and shillings.

RULE.—Multiply by the pounds, and proceed with the shillings according to case 6th and add them together, the total will be the answer in pounds.

EXAMPLES.

26 at 4l. 8s. Ans. 114l. 8s.
36 at 5l. 13s. Ans. 203l. 8s.
26 at 11l. 14s. Ans. 304l. 4s.
49 at 3l. 7s. Ans. 164. 3s.
17 at 9l. 15s. Ans. 165l. 15s.
48 at 7l. 10s. Ans. 360l
16 at 3l. 6s. Ans. 52l. 16s.
15 at 4l. 13s. Ans. 69l. 15s.
18 at 6l. 8s. Ans. 115l. 4s.

CASE IX.

When the price is pounds shillings and pence—

RULE 1.—If the shillings and pence be the aliquot part of a pound multiply by the pounds, and divide by the aliquot part, and add as before, the sum is the answer in pounds.

2. If the shillings and pence be not the aliquot part of a pound, or if there be shillings pence and farthings given with the pounds, then reduce the pounds and shillings into shillings, and multiply by the shillings, and take parts for the rest of the price and add them together as before, the sum is the answer in shillings.

EXAMPLES.

3	$\frac{1}{4}$	120 at 4l. 7s. 3d.
		87 20
		84 87
		96
		10440
		30
		5
	2|0	10447|5
		523 15 Ans.

47 at 3l. 3s. 4d. Ans. 148l. 16s. 8d.
17 at 2l. 6s. 8d. Ans. 39l. 13s. 4d.
14 at 2l. 10s. 6d. Ans. 35l. 7s.
21 at 5l. 14s. 7$\frac{1}{4}$d. Ans. 120l. 6s. 8$\frac{1}{4}$d.
70 at 1l. 14s. 7d. Ans. 121l. 0s. 10d.
46 at 3l. 19s. 8$\frac{1}{2}$d. Ans. 183l. 6s. 7d

30 at L.1 2s. 6d.	Ans.	L.33	15s.	
457 at L.14 17s. $9\frac{1}{2}d$.	Ans.	L.6804	19s.	$9\frac{1}{2}d$.
713 at L.19 19s. $11\frac{1}{4}d$.	Ans.	L.14259	5s.	$1\frac{1}{4}d$.

CASE X.

When the number whose price is required is a whole number with parts annexed.

Rule.—Work for the whole number according to the former rules, to which add $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$ of the price, according as the question requires.

EXAMPLES.

$273\frac{1}{4}$ at 2s. 6d.	Ans.	L.34	3s.	$1\frac{1}{2}d$.
$937\frac{1}{2}$ at L.3 17s. 8d.	Ans.	L.3640	12s.	6d.
$139\frac{3}{4}$ at L.1 19s. 4d.	Ans.	L.274	16s.	10d.

SIMPLE INTEREST.

Simple Interest is a gratuity allowed by the borrower of any sum of money, to the lender, according to a certain rate per cent. agreed on, which by law must not exceed L.6 for the use of L.100 for one year, and so on, in proportion for a greater or less sum, for a longer or shorter time.

Principal is the money lent.

Rate is the sum per cent. agreed on.

Amount is the principal and interest added together.

CASE I.

To find the interest of a sum, for years, months and days.

Rule 1.—Multiply the principal by the rate and cut off the two right hand figures (which is the same as dividing by 100) which must be reduced to the lowest denomination, each time cutting off as before; the figures on the left hand of the stroke of separation, are the answer for one year.

2. Multiply the interest of one year by the number of years in the question, the product is the answer for that time.

3. If there be months and days, work by Practice, allowing 30 days to a month, which is exact enough for common use.

The method of Proof is by the Rule of Three Direct.

Note.—These rules may be applied to Commission, Brokerage, Insurance, which have no respect to time, or any thing rated at so much per cent.

EXAMPLES.

1. What is the interest of £.61 13s. for 4 years, 8 months and 24 days, at 6 per cent. per annum?

			£. s. d. grs.	
£.61 13s. prin	6 mo.	$\frac{1}{2}$	3 13 11 3	interest for one year.
6			4	
3|69 18			14 15 11	interest for four years
20	2 mo.	$\frac{1}{3}$	1 16 11 3	do. 6 months.
16|98	20da.	$\frac{1}{3}$	12 3 3	do. 2 months.
12	4da.	$\frac{1}{5}$	4 1 1	do. 20 days.
11|76			9 3	do. 4 days.
4			£.17 10s. 1d. 2grs.	Ans. Int. for 4 years 8 months, and 24 days.
3|04				

2. What is the interest of £.41 6s. 10d. for four years, at 6 per cent. per annum? Ans. £.9 18s. 5d.

3. What is the interest of £.76 for 2 years at 5 per cent? Ans. £.7 12s. 0d.

4. What is the interest of £.9 16s. 7d. for 14 years, at 6 per cent.? Ans. £.8 5s. 1d.

5. What is the amount of £.400 for 12 years, at 6 per cent.? Ans. £.688.

6. What is the interest of £.30 18s. 6d. for 4 years and 7 months, at 6 per cent.? Ans. £.8 10s. 0½d.

7. What is the interest of £.15 16s. 4d. for 5 years and an half, at 6 per cent.? Ans. £.5 4s. 4½d.

8. What is the interest of £.200 for 3 years and ¼ at 5 per cent.? Ans. £.37 10s.

9. What is the amount of £.10 15s. 6d. for 16 years and 10 months, at 6 per cent.? Ans. £.21 12s. 11d.

10. What is the interest of 88 dollars for 10 months and 14 days, at 6 per cent. per annum?

D. or thus,				
88 prin. mills.	6 mo.	$\frac{1}{2}$	528 cents, int. for 1 year.	
6 rate, 88000 prin.				
6 rate.	4 mo.	$\frac{1}{3}$	264 do.	6 mo.
5|28	12da	$\frac{1}{10}$	176 do.	4 mo.
D.c. 5, 2 8 0|00	2 da.	$\frac{1}{6}$	17 6 do.	12 days.
D.d.c.m.			2 9 do.	2 days.

Ans. 4, 6 0 5 interest for 10 months and 14 days.
D d.c.m.

11. What is the amount of $400\frac{1}{4}$ dollars for 16 years and 17 days, at 6 per cent? Ans. 78E. 5D. 6d. 2c. 3m.

12. Required the amount of 43 dollars from July 4th, 1797, to June 22d, 1798, interest at the rate of 6 per cent. per annum? Ans. 45D. 4d. 9c. 3m.

13. What is the interest of 300 dollars, 87 cents, for 1 month and 21 days, at 9 per cent. per annum? Ans. 3D.$83\frac{1}{2}$c

14. What is the amount of 86D. 7d. for five years, 5 months and 24 days, at 5 per cent? Ans. 110D. 4d. 6c. 9m.

15. What is the interest of 131D. 8c. for 27 days, at 7 per cent? Ans. 6d. 8c. 8m

16. What is the interest of 1000 dollars 8 dimes for 20 days, at 6 per cent? Ans. 3D. 3d. 3c. 6m.

When the principal is very large, work for days, thus,

As 365 days, are to the interest of the principal for 1 year, so are the days given, to the interest required.

Take the last example and work it both ways,

	mills		
Prin.	1000800		
	rate 6		
	60048|00		
	mills.		
1 mo $\frac{1}{12}$	60048	int. for 1 year	
15 days $\frac{1}{2}$	5004	do. 1 mo.	
5 days $\frac{1}{3}$	2502	15 da.	
	834	5 da.	
	3, 3 3 6	int. 20	
	D.d.c.m.	da. *A.*	

da. M. da.
As 365 : 60048 : 20 : the ans.
work omitted, which is 3D. 2d. 9c.
mills
3336 ans. by practice.
329 ditto rule three.

46 difference.

The method by practice allows only 360 days to a year, which in small sums is sufficiently exact, and much more concise than the method by the rule of three.

17. What is the interest of 125000 dollars for 1 day, at the rate of 6 per cent per annum? Ans. 20D. 54c. 7m.

CASE II.

When the rate per cent is $\frac{1}{4}$ $\frac{1}{2}$ or $\frac{3}{4}$ more than the pounds given in the said rate.

RULE.—Multiply the principal by the pounds in the rate per cent. as before, and take parts for $\frac{1}{4}$ $\frac{1}{2}$ or $\frac{3}{4}$ from the principal, which add to the product; then proceed as before.

EXAMPLES.

1. What is the interest of 120*l.* for a year, at $4\frac{1}{2}$ per cent? Ans. *L.*5. 8*s.*

2. What is the interest of 300*l.* for $5\frac{1}{2}$ years at $3\frac{3}{4}$ per cent? Ans. *L.*64. 13*s.* 9*d.*

E

3. What is the amount of 2300 dollars for 3 years, at $4\frac{1}{2}$ per cent? Ans. $2593\frac{1}{4}$D.

CASE III.

To find the principal when the amount, time, and rate per cent. are given.

RULE.—As the amount of 100*l.* at the rate and time given, is to 100*l.* so is the amount given to the principal required.

EXAMPLES.

1. What principal being put to interest for 9 years at 5 per cent. per annum, will amount to *L.*725? Ans. *L.*500.

2. What sum being put to interest, will amount to *L.*520 16*s.* in 8 years, at 3 per cent. per annum? Ans. *L.*420.

CASE IV.

To find the rate per cent. when the amount, time and principal are given.

RULE 1.—As the principal is to the interest for the whole time, so is *L.*100 to the interest for the same time.

2. Divide the interest last found by the time, and the quotient is the rate per cent.

EXAMPLES.

1. At what rate of interest per cent. will *L.*500 amount to 725 in 9 years? Ans. 5 per cent.

2. At what rate of interest per cent. will *L.*420 amount to *L.*520 16*s.* in 8 years? Ans. 3 per cent.

CASE V.

To find the time, when the principal, amount and rate per cent. are given.

RULE.—As the interest of the principal for 1 year at the given rate, is to 1 year, so is the whole interest to the time required.

EXAMPLES.

1. In what time will *L.*500 amount to 725 at 5 per cent. per annum? Ans. 9 years.

2. In what time will *L.*420 amount to *L.*520 16*s.* at 3 per cent. per annum? Ans. 8 years.

COMPOUND INTEREST.

COMPOUND INTEREST is that which arises from any principal and its interest put together as the interest becomes due.

To find the interest of a sum for any number of years.

RULE 1.—Find the amount of the given sum by simple interest for the first year, which is the principal for the second year, &c. for any number of years given.

2. Subtract the given sum from the last amount, and the remainder is the compound interest.

EXAMPLES.

1. What sum will *L.*450 amount to in 3 years, at 5 per cent. per annum, compound interest? Ans. *L.*520 18*s.* $7\frac{1}{2}$*d.*

2. What will L.480 amount to in 6 years at 5 per cent. per annum, compound interest? Ans. L.643 4s. 10½d.

3. What is the amount of L.45 11s. for 8 years and 8 months at 6 per cent. per annum, compound interest? Ans. £.75 9s. 11d.

4. What is the amount of L.217, forborne 2¼ years, at 5 per cent. per ann. supposing the interest payable quarterly? Ans. L.242 13s. 4½d.

BARTER.

Barter is the exchanging of one commodity for another, and directs merchants so to proportion their goods, that neither party may sustain loss.

Note. *Barter is only an application of the single rule of three direct, and may be performed and proved by the same rule.*

EXAMPLES.

1. How much sugar at 9d. per lb. must be given in barter for 6½ cwt. of tobacco at 14d. per lb.? Ans. 10cwt. 12⅘ lb.

2. A. and B. bartered; A. had 5cwt. of sugar at 6d. per lb. which he gave to B. for a quantity of cinnamon at 10s. 8d. per lb. I demand how much cinnamon B. gave A? Ans. 26lb. 4oz.

3. B. delivered 3 hhds. of brandy at 1D. 11c. per gal. to C. for 126 yds of cloth, what was the cloth per yd? Ans. 1D. 66½c.

4. A. hath linen cloth worth 20d. an ell ready money, but in barter he will have 2s.—B. hath broadcloth worth 14s. 6d. per yard ready money, at what price ought the broadcloth to be rated in barter? Ans. 17s. 4¾ per yard.

5. A. and B. bartered.—A. had 41cwt. of hops at 30s. per cwt. for which B gave him L.20 in money, and the rest in prunes at 5d. per lb. I demand how many prunes B. gave A. besides the L.20. Ans. 17cwt. 3 qrs. 4lb.

LOSS AND GAIN.

Loss and Gain is a rule, which discovers what is gotten or lost in buying or selling goods; and instructs merchants to raise or fall their price so as to gain or lose so much per cent, &c.

Questions in this rule are performed by the rule of three direct: observing that the gains or losses are in proportion to their quantity, and the contrary.

EXAMPLES.

1. Bought 18cwt. of cheese at 28s. per cwt. which I sell out again 3½d. per lb. what is the whole gain? Ans. L.4 4s.

2. How must I sell tea per lb. that cost me 13s. 5d. to gain after the rate of 25 per cent.?

L.100 : L.125 :: 13s. 5d. : 16s. 9¼d. the answer.

3. Hats bought at 4s. each, and sold at 4s. 9d. what is the gain in laying out 100l. Ans. 18l. 15s.

4. Bought 60 reams of paper at 15s. per ream, what is the loss in the whole quantity at 4 per cent? Ans. L.1 16s.

5. Bought 7 tuns of wine at L.17 per hhd. which I sell again at 1s. per pint; I demand the whole gain, and the gain per cent Ans. 229l. 12s. the whole gain, and 48l. 4s. $8\frac{1}{4}d$. the gain per cent.

6 A draper bought 100 yards of broadcloth, for which he gave 56l. I desire to know how he must sell it per yard to gain 19l. in the whole? Ans. 15s. per yard

7. A draper bought 100 yards of broadcloth for 56l. I demand how much he must sell it per yard to gain 15l. per cent?

Ans. 12s. $10\frac{1}{2}d.$ $\frac{24}{100}$.

8. Bought cloth at $1\frac{1}{4}$D. per yard, which not proving so good as I expected, I am resolved to lose $17\frac{1}{2}$ per cent. by it; how must I sell it per yard? Ans. 1D. 3c. $1\frac{3}{4}$ m.

TARE AND TRET.

TARE AND TRET are practical rules for reducing certain allowances, which are made by merchants and tradesmen in selling their goods by weight.

Tare *is an allowance made to the buyer for weight of the box, barrel or bag, &c. which contain the goods bought, and is either at so much per box, &c. or so much per cwt. or at so much in the gross weight.*

Tret *is an allowance of 4lb. in every 104lb. for waste and dust.*

Cloff *is an allowance of 2 lb. upon every 3cwt.*

Gross weight *is the whole weight of any sort of goods, together with the box, barrell, bag, &c. which contain them.*

Suttle *is when part of the allowance is deducted from the gross,*

Neat weight *is what remains after all allowances are made.*

CASE I.

When the tare is at so much per box, barrel or bag, &c.

RULE.—Multiply the number of boxes or barrels, &c. by the Tare, and subtract the product from the gross, the remainder is the neat weight.

Quest. In 7 frails of raisins, each weighing 5cwt. 2qrs. 5lb. gross, tare 23lb per frail, how much neat? Ans. 37cwt. 1qr. 14lb.

CASE II.

When the Tare is at so much per cwt.

RULE.—Divide the gross weight by the aliquot parts of a cwt. and subtract the quotient from the gross, the remainder is the neat weight.

Quest. What is the neat weight of 7 bbls. of pot-ash, each weighing 201 lb. gross, tare being at 10 lb. per cwt.?

Ans. 1281lb. 6oz.

NOTE.—As tare and tret are only an application of the rules of proportion and practice: therefore, I shall omit all other cases and examples usually appearing in Books of this kind.

FELLOWSHIP.

FELLOWSHIP is a rule by which merchants, trading in company with a joint stock, determine each person's particular share of the gain or loss, in proportion to his share in the joint stock.

By this rule a bankrupt's estate may be divided, as also legacies adjusted, when there is deficiency of effects.

SINGLE FELLOWSHIP.

Single Fellowship is when the stock of each partner continues for an equal term of time.

RULE.—As the whole stock, is to the whole gain or loss, so is each man's particular stock, to his particular share of the gain or loss.

Method of Proof.

Add all the shares together, the sum will be equal to whole gain or loss, when the work is right.

EXAMPLES.

1. Two persons trade together—A puts in stock L.20 and B L.40, and they gain L.50, what is each person's share thereof?

L.		L.	L.	L.	L.	s.	d.	
20	A's stock.	60 :	50 ::	20 :	16	13	4	A's share.
40	B's stock.	60 :	50 ::	40 :	33	6	8	B's share.
60	whole stock.				50	0	0	Proof.

2. A, B, and C, trading together, gained 120l. which is to be shared according to each man's stock; A put in 140l. B 300l. C 160l. what is each man's share? Ans. A 28l. B 60l. C 32l.

3. Three merchants, A, B, and C, freight a ship with 340 tuns of wine; A loads 110 tuns, B 97, and C the rest. In a storm the seamen were obliged to throw 85 tuns overboard; how much must each sustain of the loss?

Ans. A 27½, B 24¼, and C 33¼.

4. A merchant is indebted to S 70l. to T 400l. to V 140l. 12s. 6d.—but upon his decease, his estate is found to be worth no more than 409l. 14s. how must it be divided among his creditors?

Ans. S must have 46l. 19s. 3¼d. T 268l. 7s. 7¼d. V 94l. 7s. 0½d.

5. A and B venturing equal sums of money, clear by joint trade L.154—by agreement, A was to have 8 per cent. because he spent his time in the execution of the project, and B was to have only 5 per cent. what was A allowed for his trouble? Ans. L.35 10s. 9¼d.

DOUBLE FELLOWSHIP.

Double Fellowship is when stocks continue an unequal term of time.

RULE.—Multiply each man's stock and time together, then say, as the sum of those products, is to the whole gain or loss, so is each product to its share of the gain or loss.

The method of proof as in Single Fellowship.

EXAMPLES.

1. A, B, and C, hold a piece of ground in common, for which they are to pay 35*l.* 10*s.* 6*d.* A put in 23 oxen 27 days, B 21 oxen 35 days, and C 16 oxen 23 days—what ought each man to pay of the rent?

Ans. A 13*l.* 3*s.* 1$\frac{1}{2}$*d.* B 15*l.* 1*s.* 5*d.* C 7*l.* 15*s.* 11*d.*

2. Three persons join in trade—A puts in 400*l.* for 9 months; B 680*l.* for 5 months, and C 110*l.* for 12 months; but by misfortune they lose goods to the value of £500: what must each man sustain of the loss?

Ans. A 216*l.* 6*s.* 11*d.* B 204*l.* 6*s.* 6$\frac{1}{2}$*d.* C 79*l.* 6*s.* 6$\frac{1}{2}$*d.*

3. Three merchants entered into partnership for 18 months: A put into stock at first 200*l.* and at 8 months end he put in 100*l.* more, and 2 months after that he put in 50*l.* more —B put in at first 550*l.* at 4 months end he took out 140*l.* and three months after he took out 110*l.* more—C put in at first 600*l.* at 2 months end he took out 250*l.* and 12 months after he put in 300*l.*—at the expiration of the time they found they had gained 526*l.*—what is each man's just share?

Ans. A 133*l.* 5*s.* 11*d.* B 179*l.* 8*s.* 5*d.* C 213*l.* 5*s.* 7*d.*

ALLIGATION.

ALLIGATION teaches how to mix several simples of different qualities, so that the composition may be of a mean or middle quality. It consists of two kinds—Alligation Medial and Alligation Alternate.

ALLIGATION MEDIAL.

Alligation Medial is the method of finding the rate of the compound, from having the prices and quantities of several simples given.

RULE.—As the sum of the quantities, or whole composition is to their total value; so is any part of the composition to its mean price or value.

PROOF.—Find the value of the whole composition at the mean price and it will agree with the total value of the several quantities at their respective prices if the work be right.

EXAMPLES.

1. A man would mix 12 gallons of wine at 1$\frac{1}{4}$D. per gallon, 9 gallons at 1D. 50c. per gallon, 15 gallons at 1$\frac{1}{2}$D. per gallon and 10 gallons at 1D. 31c. per gallon. What will one gallon of this mixture be worth?

gal.	c.		c.
12	at 125	comes to	1500
9	150		1350
15	175		2625
10	131		1310
46	Sum of quantities.		6785 Total value.

	mills.
Mean price	1475
Sum of quantities	46
	8850
	5900
Proof	67,850 total value of the whole composition.
	Dolls.

As 46 : 6785 :: 1 gal.
1
D.d.cts.
46)6785(1,47 5 Ans.
46
218
184
345
322
230
230

2. Suppose 15 bushels of wheat at 5s. per bushel and 12 bushels of rye at 3s. 6d. per bushel were mixed together; how must the compound be sold per bushel? Ans. 4s. 4d.

3. A composition being made of 5lb. of tea at 1D. 16c. 6m. per lb. 9lb. at 1D. 25c. per lb. and 14lb. at 68 c. per lb.—What is a pound of it worth? Ans. 95cts.

4. A man would mix three bushels of flour at 3s. 5d. per bushel, 4 bushels at 5s. 6d. per bushel, and 5 bushels at 4s. 8d. per bushel. What is a bushel of this mixture worth? Ans. 4s. 7½d.

5. A goldsmith has 3lb. of gold of 22 carats fine* and 3lb. of 20 carats fine. What fineness will an ounce of this mixture bear? Ans. 3×22=66, and 3×20=60: then 66+60÷6=21.

6. A refiner having 5lb. silver bullion, of 8oz. fine,† 10lb. of 8oz. fine, and 15lb. of 6oz. fine, would melt all together: What fineness will 1lb of this mass be? Ans. 6oz. 13pwts. 8gr.

7. A refiner melts 10lb. of gold of 20 carats fine with 16lb. of 13 carats fine; how much alloy must be put to it to make it 22 carats fine? first find how many carats fine it will bear, thus, 10×20=200 and 16×18=288. Then 200+288÷26 =18$\frac{20}{26}$ or 18$\frac{10}{13}$.

It appears from the operation that it will bear only 18$\frac{10}{13}$ carats fine therefore it wants 3$\frac{3}{13}$, parts of gold to be added to make the fineness required in the question, viz 22 carats fine.

*If an ounce, or any other quantity of pure gold be reduced into 24 equal parts, these parts are called carats: but gold is often mixed with some baser metal which is called alloy, and the mixture is said to be of so many carats fine according to the proportion of pure gold in it: Thus if 22 carats of pure gold, and 2 of alloy be mixed together it is said to be 22 carats fine. Such gold as will endure the fire without loss, is allowed 24 carats fine: If it lose 2 carats in trial it is called 22 carats fine.

†If 1lb. of silver lose nothing in trial, it is 12 oz. fine; but, if it lose 4 pwts. it is 11oz. 16pwts. fine, &c.

ALLIGATION ALTERNATE.

Alligation Alternate is when the prices of several ingredients are given to find such quantities of each of them as are necessary to make a mixture of a given price. It is the reverse of *Alligation Medial*, and is proved by it.

RULE 1.—Write the prices of the quantities or simples expressed in one name, in a column under one another, the least at the top and so by degrees downwards as they increase and at the left of these, write the mean price expressed in the same name.

2. Connect or link with a curve line the price of each quantity which is less than the mean price, with one or any number of those which are greater than the mean price; and each price which is greater than the mean, with one or any number which is less.

3. Write the difference betwixt the mean (or mixture price) and that of each of the simples, opposite the prices with which they are connected. Then if only one difference stand against any price it will be the quantity belonging to that price: but if there be several their sum will be the quantity.

EXAMPLES.

1. How much rye at 4s. per bushel, barley at 3s. and oats at 2s. per bushel, will make a mixture worth 2s. 6d. per bush.

	d.		bush. s.
d.	24	18+6	24 at 2 viz. 24 bu. of oats.
Mean price 30	36	6	6 at 3 6—of barley.
	48	6	6 at 4 6—of rye.

bush.	bush.	bush.	s.	bush.
24	6	6	48	24
2	3	4	18	6
—	—	—	24	6
48	18	24	—	—
			90	36

PROOF.

bush. s. bush. s. d.
As 36 : 90 : : 1 : 2 6 mean price.

Questions of this sort admit of a great variety of answers for having found one answer, we may find as many more as we please, by only multiplying or dividing each of the quantities found by 2, 3, or 4, &c. the reason of which is evident for if two quantities of two simples, make a balance of loss and gain, with respect to the mean price, so must also the double or treble, the ½ or ⅓ part, or any other ratio of these quantities and so on without end.

If any of the simples be of little or no value with respect to the rest, its rate is supposed to be nothing, as water mixed with wine, and alloy with gold and silver.

2. How much barley at 85 cents per bushel and oats at 50 cents per bushel must be mixed together, that the composition may be worth 66 cents per bushel.

		c.	bu.	c.	bush.
	c.	50	19 at	50 viz.	19 of oats,
Mean price 66		85	16	85	16 of barley.

3. It is required to mix brandy at 8*s.* wine at 7*s.* cider at 1*s.* and water at 0 per gallon together, so that the composition may be worth 5*s.* per gallon?

			gal. s.	gal.		or thus, gal.
	0	3+2	5 at 0 viz.	5 of water	0	3 of water.
S.	1	3+2	5 at 1	5 of cider	1	2 of cider.
Mean	7	4+5	9 at 7	9 of wine	7	4 of wine.
rate. 5	8	5+4	9 at 8	9 of bran.	8	5 of brandy.

By the last example it will be seen that many questions in Alligation Alternate will admit of several answers by the various ways of connecting or linking the prices of the quantities, and all the answers satisfy the condition of the question, by having a just proportion or balance among themselves. The pupil will obtain a clearer idea of this remark, by proving such questions.

4. A Goldsmith has gold at 17, 18, 22, and 24 carats fine—how much must he take of each to make it 21 carats fine?

Ans. 3 of 17, 1 of 18, 3 of 22, and 4 of 24.

5. A merchant has canary wine at 50 cents per gallon; sherry at 33c. and claret at 24c. per gal. which he would mix with water, that the mixture may be worth 40c. per gal. How much of each must he take?

Ans. 10 gal. of water, 10 of claret, 10 of sherry & 63 of canary.

6. A merchant has tea at 12*s.* 11*s.* 9*s.*, & 8*s.* per lb. how much of each must he mix together that the composition may be afforded at 10*s.* per lb.? *Ans. 3lb. of each sort.

RULE 2.

When the whole composition is limited to a certain quantity.

Find an answer as before by linking; then say, As the sum of the quantities thus determined, is to the given quantity, so is each quantity (found by linking) to the required quantity of each.

EXAMPLES.

1. A grocer has 4 sorts of sugar, viz. at 8d. 6d. 4d. & 2d. per lb. and he would have a composition of an cwt. worth 5d. per lb. How much of each sort must he have?

N. B. This question will admit of 7 answers, by as many ways of linking, 1 of which I will give, that is, 28lb. of each sort. See the work.

* Seven answers may be found to this question by as many different ways of linking the prices of the simples.

	d.	lb.		lb.		lb.	d.	
	2	3+1	4			4 : 28	at 2	
d.	4	3+1	4	lb.	lb.	4 : 28	4	per
Mean rate 5	6	3+1	4	As 16 :	112 ::	4 : 28	6	lb.
	8	3+1	4			4 : 28	8	

Sum of the quantities 16 — 112

These questions may be proved thus—first find how much money it takes to make the composition—then see how much it will come to; if the sums agree, the work is right.

2. Suppose a man had 3 sorts of tea, at 24c. per lb. 50c. per per lb. and 75c. per lb.—The worst (being musty) would not sell; the best was too dear. He concluded to mix 100lb. and to take so much of each sort as he could afford to sell the composition at 56c. per lb.—How much of each sort did he take. Ans. 25lb. at 24c. per lb. 25 at 50c. and 50 at 75c.

3. How many gallons of water must be mixed with wine at 3s. per gal. to fill a vessel of 100 gal. and that a gal. may be afforded at 2s. 6d.?

Ans. $83\frac{1}{3}$ gal. of wine & $16\frac{2}{3}$ gal. of water.

4. A Goldsmith has 3 sorts of gold, viz. 22, 21, and 20 carats fine, and he would mix with these so much alloy, as that the quantity of 21 oz. may bear 18 carats fine; how much of each sort, and how much alloy must he take?

Ans. 6 oz. of each sort of gold, and 3 oz. of alloy.

RULE 3.

When one of the ingredients is limited to a certain quantity.

Take the difference between each price and the mean rate as in rule 1 and 2, then say, as the difference standing against the simple whose quantity is given, is to the quantity given, so is each of the other differences severally, to the several quantities required.

EXAMPLES.

1. A grocer has 20lb. of tea, at 40c. per lb. which he would mix with some at 60c. per lb. some at 1D. and some at 1D. 20c. per lb. How much of each sort must he take to mix with the 20lb. that he may sell the composition at 80c. per lb.?

	c.	lb.		lb.		lb.		
	40	40 stand against the quantity given.						
c.	60	20		lb.		lb.		
80	100	20		20	:	10	at 60c.	
	120	40	As 40 : 20 ::	20	:	10	1D	per
				40	:	20	1D,20c.	lb.

Proof by Alligation Medial.

lb.	D. c.		c.		lb.	c.	lb.
10 at	,60	*comes to*	600	As	60 :	4800 : :	1
10	1,00		1000				1
20	1,20		2400				c.
20	,40		800		60)4800(80 *ans. & proof.*		
					480		

Sum 60 of quantities. 4800 *total value of the composition.*

2. How much gold of 15, of 17, and of 22 carats fine, must be mixed with 5 oz. of 18 carats fine, so that the composition may be 20 carats fine?

Ans. 5 oz. of 15 carats fine, 5 oz. of 17, and 25 of 22.

3. Mix 12 bushels of oats at 1s. 6d. per bush. with barley at 2s. 6d. with rye at 3s. with wheat at 4s. per bushel. How much barley rye and wheat must be mixed with the 12 bushels of oats, that the mixture may be worth 2s. 9d. per bushel.

Ans. 12 bushels of each sort.

Let the pupil find all the answers which may be found to the last question by linking.

DOUBLE RULE OF THREE.

This Rule has five terms which are given in the question to find a sixth.

The three first terms are a supposition; the two last are a demand.

RULE 1.—Let the principal cause of loss or gain, interest or decrease, action or passion, be put in the first place.

2. Let that which betokeneth time, distance of place, and the like, be put in the second place, and the remaining one in the third place.

3. Place the other two terms under their like in the supposition.

4. If the blank fall under the third term, multiply the first and second terms for a devisor, and the other three for a dividend.

5. If the blank fall under the first or second term, multiply the 3d and 4th terms for a devisor, and the other three for a dividend, the quotient will be the answer.

The method of proof is by the Single Rule of Three.

EXAMPLES.

1. If 7 men can reap 84 acres of wheat in 12 days, how many men can reap 100 acres in 5 days?

M. da. acr.
7—12—84 420)8400(20 answer.
5 100 840

84 100
5 12
420 divisor. 1200
7
8400 Dividend.

d. m. da.
5—$8\frac{1}{3}$—12
12
6)100
20 Proof.

acr. m. acr.
84—7—100
100
7)700
12)100
$8\frac{4}{12}$ = $\frac{1}{3}$

☞ The answer of the first stating must be the middle number of the second, in the proof.

2. If 7 qrs. of malt are sufficient for a family of 7 persons for 4 months, how many qrs. are enough for 46 persons ten months? Ans. 115qrs.

3. If 8 reapers have £.3 4s. for 4 days work, how much must 48 men have for 16 days work? Ans. £.76 16s.

4. If a footman travel 240 miles in 12 days, when the days are 12 hours long; how many days of 16 hours long may he travel 720 miles? Ans. 27 days.

5. If £.700 in half a year raise £.14 interest, how much will £.400 raise in 5 years? Ans. £.80

6. An usurer put out £.86 to receive interest for the same; and when it had continued 8 months, he received for principal and interest £.88 17s. 4d. at what rate per cent. per annum did he receive interest? Ans. 5 per cent.

7. If 20 dogs for 30 groats, go 40 weeks to grass; How many Hounds for 60 crowns may winter in that place? Ans. 2000 hounds.
(Call a Crown 5s.)

VULGAR FRACTIONS.

Vulgar Fractions are represented by two numbers placed one above the other, with a line drawn between them thus, $\frac{7}{8}$, $\frac{4}{8}$, and are broken numbers, and signify the part or parts of a whole number.

The figure above the line is called the *numerator*, and that below the line *denominator*.

Fractions are either proper, or improper, compound or mixed.

1. A Proper Fraction is when the numerator is less than the denominator $\frac{3}{4}$, $\frac{1}{3}$, $\frac{5}{9}$, &c.

2. An Improper Fraction is when the numerator is greater than the denominator, as $\frac{8}{5}$, $\frac{112}{21}$, &c.

3. A Compound Fraction is a fraction of a fraction, as $\frac{1}{2}$ of $\frac{3}{8}$ of $\frac{1}{3}$, &c.

4. A mixed number is composed of a whole number and a fraction, as $8\frac{1}{5}$ $17\frac{4}{7}$, &c.

Any whole number may be expressed like a fraction by writing 1 underneath it.

REDUCTION OF VULGAR FRACTIONS.

CASE. I.

To reduce vulgar fractions to a common denominator.

RULE 1.—Multiply each numerator into all the denominators but its own, for a new numerator.

2. Multiply all the denominators for a common denominator.

EXAMPLES.

1. Reduce $\frac{3}{6}$ and $\frac{5}{8}$ to a common denominator. Ans. $\frac{24}{48}$ & $\frac{30}{48}$.
2. Reduce $\frac{7}{8}$, $\frac{9}{10}$ and $\frac{11}{12}$ to a common denominator. Ans. $\frac{840}{960}$ $\frac{864}{960}$, and $\frac{880}{960}$.
3. Reduce $\frac{6}{10}$, $\frac{4}{8}$, $\frac{1}{9}$ and $\frac{6}{7}$, to a common denominator. Ans. $\frac{3024}{5040}$, $\frac{2520}{5040}$, $\frac{560}{5040}$, and $\frac{4320}{5040}$.
4. Reduce $\frac{4}{9}$, $\frac{7}{11}$, $\frac{6}{7}$, and $\frac{1}{2}$ to a common denominator. Ans. $\frac{616}{1386}$, $\frac{882}{1386}$, $\frac{1188}{1386}$ and $\frac{693}{1386}$.

CASE II.

To reduce a vulgar fraction to its lowest terms.

RULE 1—Find a common measure by dividing the lower term by the upper, and that divisor by the remainder following, till nothing remain; the last divisor is the common measure.

2. Divide both parts of the fraction by their greatest common measure, and the quotient will make the fraction desired. *This case will prove case 1.*

EXAMPLES.

1. Reduce $\frac{48}{56}$ to its lowest terms. Ans. $\frac{6}{7}$.
2. Reduce $\frac{72}{94}$ to its lowest terms. Ans. $\frac{36}{47}$.
3. Reduce $\frac{84}{170}$ to its lowest terms. Ans. $\frac{42}{85}$.
4. Reduce $\frac{60}{125}$ to its lowest terms. Ans. $\frac{12}{25}$.

CASE III.

To reduce a mixt number to an improper fraction.

RULE 1.—Multiply the whole number into the denominator of the fraction.

2. To the product, add the numerator, for a new numerator.

3. Let its denominator be the denominator given.

EXAMPLES.

1. Reduce $12\frac{15}{17}$ to an improper fraction. Ans. $\frac{219}{17}$.
2. Reduce $19\frac{12}{18}$ to an improper fraction. Ans. $\frac{354}{18}$.
3. Reduce $16\frac{18}{100}$ to an improper fraction. Ans. $\frac{1618}{100}$.
4. Reduce $100\frac{19}{59}$ to an improper fraction. Ans. $\frac{5919}{59}$.

CASE IV.

To reduce an improper fraction to its proper terms.

RULE —Divide the upper term by the lower.

This case and case three prove each other.

EXAMXLES.

1. Reduce $\frac{219}{17}$ to its proper terms. Ans. $12\frac{15}{17}$.
2. Reduce $\frac{141}{17}$ to its proper terms. Ans. $8\frac{5}{17}$.
3. Reduce $\frac{126}{48}$ to its proper terms. Ans. $2\frac{30}{48}$.
4. Reduce $\frac{13}{7}$ to its proper terms. Ans. $1\frac{6}{7}$.

CASE V.

To reduce a compound fraction to a single one.

RULE 1.—Multiply all the numerators for a new numerator.

2. Multiply all the denominators for a new denominator.

EXAMPLES.

1. Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ to a single fraction. Ans. $\frac{6}{24}$.
2. Reduce $\frac{12}{14}$ of $\frac{5}{6}$ of $\frac{1}{2}$ to a single fraction. Ans. $\frac{60}{168}$.

CASE VI.

To reduce the fraction of one denomination to the fraction of another, but greater, retaining the same value.

RULE 1.—Reduce the given fraction to a compound fraction, by comparing it with all the denominations between it and the denomination which you would reduce it to.

2. Reduce that compound fraction to a single one by case 5.

EXAMPLES.

1. Reduce $\frac{5}{6}$ of a penny to the fracuon of a pound. A. $\frac{5}{1440}l$.
2. Reduce $\frac{8}{9}$ of an oz. Troy to the fraction of a pound. Ans. $\frac{8}{108}$.
3. Reduce $\frac{6}{7}$ of a lb. Avoirdupois to the fraction of a cwt.. Ans. $\frac{6}{784}$.
4. Reduce $\frac{9}{13}$ of a pint of wine to the fraction of a hhd. Ans. $\frac{9}{6552}$ hhd.

CASE VII.

To reduce the fraction of one denomination to the fraction of another, but less, retaining the same value.

RULE—Multiply the given numerator, by the parts of the denominations between it, and that denomination you would reduce the fraction to, for a new numerator, and place it over the given dedominator. [*This case and case 6 prove each other.*]

EXAMPLES.

1. Reduce $\frac{5}{1440}$ of a pound to the fraction of a penny. Ans. $\frac{1200}{1440}=\frac{5}{6}$.
2. Reduce $\frac{1}{96}$ of a shilling to the fraction of a farthing. Ans. $\frac{1}{2}$qr.
3. Reduce $\frac{8}{108}$ of a lb. Troy to the fraction of an oz. A. $\frac{8}{9}$
4. Reduce $\frac{9}{6552}$ a hhd. of wine to the fraction of a pint. Ans. $\frac{9}{13}$.

CASE VIII.

To find the value of a fraction in the known parts of the integer.

RULE.—Multiply the numerator by the common parts of the integer, and divide by the denominator.

EXAMPLES.

1. What is the value of $\frac{2}{3}$ of a pound? Ans. 13*s*. 4*d*.
2. What is the value of $\frac{5}{7}$ of a shilling? Ans. $8\frac{4}{7}$*d*.
3. What is the value of $\frac{18}{43}$ of a shilling? Ans. $5\frac{1}{43}$*d*.
4. What is the value of $\frac{6}{7}$ of £.5 9*s*.? Ans. £ 4 13*s*. $5\frac{1}{7}$*d*.
5. What is the value of $\frac{12}{16}$ of a lb. Troy? Ans. 9oz.
6. What is the value of $\frac{12}{78}$ of a ton?
   Ans. 3cwt. 8lb. 9oz. 13dr.
7. What is the value of $\frac{9}{11}$ of 10cwt. 1qr. 12lb.?
   Ans. 8cwt. 1qr. 25lb. 1oz. 7dr.
8. What is the value of $\frac{4}{7}$ of a mile?
   Ans. 4 fur. 125yds. 2ft. 1in. 2b.c. $\frac{1}{7}$.
9. What is the value of $\frac{7}{8}$ of a yd. of cloth? Ans. 3qrs. 2n.
10. What is the value of $\frac{4}{5}$ of a month?
    Ans. 3we. 1d. 9h. 36min.

CASE IX.

To reduce any given quantity to the fraction of any greater denomination of the same kind.

RULE 1.—Reduce the given quantity to the lowest terms mentioned for a numerator.

2. Reduce the integral part to the same term for a denominator, and that will be the fraction required.

NOTE.—If there be a fraction given with the said quantity, let it be put to the numerator of the fraction required.

Case 8 and 9 prove each other.

EXAMPLES.

1. Reduce 13*s*. 4*d*. to the fraction of a pound. Ans. $\frac{160}{240}=\frac{2}{3}$*l*.
2. Reduce 5*d*.$\frac{1}{43}$ to the fraction of a shilling.
   $43\times5+1=216$ num. $43\times12=516$ den. $\frac{216}{516}=\frac{18}{43}$*s*. Ans.
3. What part of £.5 9*s*. is £.4 13*s*. 5*d*. $\frac{1}{7}$? Ans. $\frac{6}{7}$.
4. Reduce 1 hhd. 49 gal. of wine to the fraction of a tun.
   Ans. $\frac{4}{9}$.
5. Reduce 2ft 8in. 1b.c. $\frac{2}{10}$ to the fraction of a yd. Ans. $\frac{9}{10}$yd.

ADDITION OF VULGAR FRACTIONS.

RULE 1.—Reduce the given fractions to a common denominator.

2. Add all the numerators together for a new numerator; under which subscribe the common denominator.

EXAMPLES.

1. Add $\frac{1}{2}$ and $\frac{7}{8}$ together? Ans. $1\frac{1}{16}$.
2. Add $\frac{7}{10}$ and $\frac{11}{12}$ and $\frac{4}{5}$ together. Ans. $2\frac{66}{1\text{[illegible]}}$.

3. Add 19 and 7 and $\frac{1}{2}$ of $\frac{2}{3}$ together. Ans. $26\frac{1}{3}$.
4. Add $\frac{1}{2}$ of $\frac{7}{8}$ and $\frac{8}{3}$ of $\frac{19}{80}$ together. Ans. $1\frac{68}{960}$.
5. Add $\frac{1}{3}$ of 95 and $\frac{7}{8}$ of 14 together. Ans. $43\frac{22}{24}$.
6. Add 6 and $\frac{7}{8}$ of $\frac{9}{10}$ and $\frac{4}{7}$ of $\frac{1}{2}$ and $7\frac{1}{2}$ together. Ans. $14\frac{1284}{2240}$.

NOTE.—To find the following answers, use case 8, in reduction, and add as in the whole numbers.

7. Add $\frac{7}{8}$ of a pound to $\frac{3}{4}$ of a shilling. Ans. 18*s.* 3*d.*
8. Add $\frac{1}{4}$ of a penny to $\frac{1}{9}$ of a pound. Ans. 2*s.* 3*d.* 1qr. $\frac{2}{3}$.
9. Add $\frac{2}{3}$ of a yard, $\frac{3}{4}$ of a foot, and $\frac{7}{8}$ of a mile together. Ans. 1540yds. 2ft. 9in.
10. Add $\frac{1}{3}$ of a week, $\frac{1}{4}$ of a day, and $\frac{1}{2}$ of an hour together. Ans. 2da, $14\frac{1}{2}$ho.

SUBTRACTION OF VULGAR FRACTIONS.

RULE.—Prepare the fractions as in addition, and the difference of the numerators, written above the common denominator, will give the difference of the fractions required.

This rule is proved by Addition

EXAMPLES.

1. From $\frac{111}{112}$ take $\frac{3}{4}$. Ans. $\frac{108}{448}$.
2. From $96\frac{1}{3}$ take $14\frac{3}{7}$ Ans. $81\frac{19}{21}$.
3. From 96 take $\frac{2}{5}$. Ans. $95\frac{3}{5}$.
4. From $\frac{1}{3}$ of 76 take $\frac{3}{4}$ of 21. Ans. $9\frac{7}{12}$.
5. From $71\frac{1}{2}$ take $\frac{17}{19}$. Ans. $70\frac{23}{38}$.
6. From $14\frac{1}{4}$ take $\frac{2}{3}$ of 19. Ans. $1\frac{7}{12}$.
7. From $\frac{1}{2}$ of a pound take $\frac{3}{4}$ of a shilling. Ans. 9*s.* 3*d.*
8. From $\frac{1}{2}$ of a shilling take $\frac{3}{4}$ of a penny. Ans. $5\frac{1}{4}$*d.*
9. From $\frac{1}{4}$ of an cwt. take $\frac{7}{12}$ of a lb. Ans. 1qr. 27lb. 6 oz. 10dr. $\frac{8}{12}$.
10. From 4da. $7\frac{1}{2}$ho. take 1d. 9ho. $\frac{3}{18}$. Ans. 2da. $22\frac{1}{3}$ho.

MULTIPLICATION OF VULGAR FRACTIONS.

RULE 1.—Prepare the given numbers (if need be) by the rules of reduction.

2. Multiply all the numerators for a new numerator, and all the denominators for a new denominator.

NOTE.—When any number, either whole or mixt, is multiplied by a fraction, the product is always less than the multiplicand, in the same proportion as the multiplying fraction is less than 1 or an unit.

EXAMBLES.

1. Multiply $\frac{3}{7}$ by $\frac{3}{11}$. Ans. $\frac{9}{77}$.
2. Multiply $\frac{1}{3}$ of $\frac{4}{5}$ by $\frac{7}{10}$ of $\frac{11}{12}$. Ans. $\frac{308}{1800}$.
3. Multiply $7\frac{1}{4}$ by $8\frac{1}{2}$. Ans. $61\frac{5}{8}$.
4. Multiply $\frac{7}{8}$ by $13\frac{9}{10}$. Ans. $12\frac{13}{80}$.
5. Multiply $\frac{1}{2}$ of 7 by $\frac{3}{8}$. Ans. $1\frac{9}{42}$.
6. Multiply $\frac{3}{6}$ by $\frac{4}{9}$ of 11. Ans. $2\frac{24}{54}$.

7. Multiply $\frac{4}{5}$ of 91 by $71\frac{1}{2}$. Ans. $5205\frac{2}{10}$.
8. Multiply $7\frac{1}{2}$ by $9\frac{1}{4}$. Ans. $69\frac{3}{8}$.
9. What is the continual product of $\frac{4}{5}$, $3\frac{1}{4}$, 5, and $\frac{3}{4}$ of $\frac{3}{5}$? Ans. $4\frac{7}{8}$.

DIVISION OF VULGAR FRACTIONS.

Rule.—Prepare the fractions as before, then invert the divisor and proceed exactly as in Multiplication.

Multiplication and Division prove each other.

EXAMPLES.

1. Divide $\frac{17}{21}$ by $\frac{3}{5}$. Ans. $1\frac{22}{63}$.
2. Divide $\frac{14}{15}$ by $\frac{7}{10}$. Ans. $1\frac{14}{42}$.
3. Divide $1\frac{1}{2}$ by $4\frac{8}{10}$. Ans. $\frac{40}{93}$.
4. Divide $\frac{7}{8}$ by 4. Ans. $\frac{7}{32}$.
5. Divide 99 by 108. Ans. $\frac{99}{108}$.
6. Divide $\frac{1}{3}$ of 19 by $\frac{2}{9}$ of $\frac{3}{4}$. Ans. $7\frac{13}{30}$.
7. Divide $4\frac{5}{9}$ by $\frac{5}{9}$ of 4. Ans. $2\frac{1}{20}$.
8. Divide $\frac{5}{9}$ of 4 by $4\frac{5}{9}$. Ans. $\frac{20}{41}$.

THE SINGLE RULE OF THREE DIRECT IN VULGAR FRACTIONS.

Rule.—The operation of the rule of three in Fractions, both single and double, vulgar and decimal, are exactly agreeable to the principles laid down in the same rules in whole numbers.

EXAMPLES.

1. If $\frac{11}{13}$lb. of sugar cost $\frac{7}{15}$ of a shilling, what cost $\frac{32}{43}$lb.? Ans. $\frac{2912}{7095}s.=4d.$ 3qrs.$\frac{4971}{7095}$.
2. If $\frac{3}{5}$ ell cost £$\frac{2}{3}$ what cost $\frac{12}{17}$ ell? Ans. 15s. 8d. $\frac{36}{153}$.
3. If 2oz. of silver 16s. 5d. what cost $\frac{3}{4}$oz? Ans. 6s. 1d 3q. $\frac{1}{8}$.
4. If $6\frac{1}{2}$yds. cost 18s. what cost $9\frac{1}{4}$yds.? Ans. £1 5s. 7d.$\frac{1}{4}$ $\frac{22}{52}$.
5. If 1yd. of cloth cost $15\frac{3}{8}$s. what will 4 pieces, each $27\frac{1}{8}$yds. cost? Ans. £84 3s. 6d.$\frac{3}{4}$.
6. A mercer bought $3\frac{1}{2}$ pieces of silk, each containing $24\frac{1}{2}$ yds. at 6s.$\frac{1}{2}$ per yard, what does the whole come to? Ans. £25 14s. $6\frac{1}{2}$d.$\frac{1}{3}$.
7. If $\frac{3}{4}$lb. less by $\frac{1}{6}$ cost 13d.$\frac{1}{5}$, what cost 14lb. less by $\frac{1}{5}$ of 2 lb.? Ans. £4 9s. 9d.$\frac{3}{25}$.
8. A merchant had $5\frac{8}{9}$cwt. of sugar, at $6\frac{1}{4}$d. per lb. which he would barter for tea, at $8\frac{5}{8}$s. per lb. I demand how much tea must be given for the sugar? Ans. 43lb.$\frac{6}{414}$.
9. If $\frac{3}{8}$ of a yard cost $\frac{7}{12}$ of a £. what will $\frac{6}{15}$ of an English ell cost? Ans. 9s. 8d. $\frac{11}{54}$.
10. Bought 122lb. of tea, at 8s. $\frac{5}{8}$ per lb. and sold it for £70—what was the gain per cent? Ans. £33 0s. $11\frac{1}{2}$d.
11. If $\frac{5}{8}$ of a gallon cost $\frac{5}{8}$ of a £. what will $\frac{5}{9}$ of a tun cost? Ans. £140.

12. A person left 40s. to 4 poor widows—to A he left $\frac{1}{3}$, to B $\frac{1}{4}$, to C $\frac{1}{5}$, and to D $\frac{1}{6}$, desiring the whole might be distributed accordingly; I demand the proper share of each?
Ans. A must have 14s.0d.$\frac{16}{38}$, B 10s. 6d.$\frac{12}{38}$, C 8s.5d.$\frac{2}{38}$, D 7s.0d.$\frac{8}{38}$.

THE SINGLE RULE OF THREE INVERSE IN VULGAR FRACTIONS.

EXAMPLES.

1. If 3$\frac{1}{4}$yds. of cloth that is 1$\frac{1}{5}$yd. wide be sufficient to make a cloak, how much must I have of that sort which is $\frac{4}{5}$ of a yard wide to make a cloak of the same bigness? Ans. 4$\frac{7}{8}$yds.

2. What quantity of shalloon that is $\frac{3}{4}$yd. wide, will line 7$\frac{1}{2}$ yds. of cloth that is 2$\frac{1}{2}$yds. wide? Ans. 25yds.

3. A regiment of soldiers consisting of 976men are to be new clothed, each coat to contain 2$\frac{1}{2}$yds. of cloth that is 1$\frac{5}{8}$yd. wide, and lined with shalloon $\frac{7}{8}$yd. wide, how many yards of shalloon will line them? Ans. 4531yds. 1qr. 2$\frac{6}{7}$na.

DECIMAL FRACTIONS.

A decimal fraction is that whose denominator is one with as many cyphers annexed as the numerator has places; and is expressed by writing the numerator only, with a point before it on the left hand, thus, $\frac{5}{10}$, $\frac{25}{100}$, $\frac{75}{1000}$, $\frac{123}{100000}$, &c. are decimal fractions, and are expressed by .5 .25 .075 .00123 respectively.

A whole number and a decimal after it is a mixt number thus, 47.5 and 5.25 are mixt numbers, signifying 47 whole numbers, and $\frac{5}{10}$ or $\frac{1}{2}$—the other is five whole numbers, and $\frac{25}{100}$ or $\frac{1}{4}$

Cyphers at the right hand of decimals make no alteration in their value, but if they are placed on their left hand, they decrease their value in a tenfold proportion.

N. B.—.5 signifies $\frac{1}{2}$, .25, $\frac{1}{4}$, and .75, $\frac{3}{4}$ of any thing.

TABLE.

6	5	4	3	2	1	2	3	4	5	6
C Thousands.	X Thousands.	Thousands.	Hundreds.	Tens.	Units.	Tenth parts.	Hundredth parts.	Thousandth parts.	X Thousandth parts.	C Thousandth parts.

ADDITION AND SUBTRACTION OF DECIMALS.

Rule.—Place the numbers according to their value, and work as in Addition and Subtraction of whole numbers.

Examples in Addition.

1. Add 25.074, 1.8254, 125, .0567876, 1776.111 together.
Ans. 1928.0671876.

2. Add 376, 25, 86.125, 637.4725, 6.5, 358.865, 41.02 together. Ans. 1506.2325.

Examples in Subtraction.

From	2464.21	712.1407	76.	127.19
Take	327.07643	704.46	.25	48.
Diff.				

MULTIPLICATION OF DECIMALS.

RULE 1.—Place the factors, and multiply them as in whole numbers.

2. Point off as many figures from the product as there are decimal places in both the factors; and if there be not so many places in the product, supply the defect by prefixing cyphers to the decimal point.

EXAMPLES.

1. Multiply 79.347 by 23.15. Ans. 1836.88305.
2. Multiply .63478 by .8264. Ans. .524582192.
3. Multiply .385746 by .00463. Ans. .00178600398.
4. Multiply .0027 by 41. Ans. .1107.

DIVISION OF DECIMALS.

RULE 1.—Divide as in whole numbers, and from the right hand of the quotient point off as many places for Decimals as the decimal places in the dividend exceed those of the divisor.

2. If the places of the quotient be not so many as the rule requires, supply the defect by prefixing cyphers.

3. If at any time there be a remainder, or the decimal places in the divisor be more than those of the dividend, cyphers may be prefixed to the dividend, and the quotient carried on to any degree of exactness.

XAMPLES.

1. Divide .48624097 by 179. Ans. .0027164S.
2. Divide 63 by .12. Ans. 525.
3. Divide .063 by 12. Ans. .00525.
4. Divide 3.747565 by 47.15. Ans. .0794, &c.
5. Divide 27 by .2628. Ans. 102.73972, &c.
6. Divide 14 by 7854 Ans. 17.825, &c.
7. Divide 234.70525 by 64.25. Ans. 3.653.
8. Divide 217.568 by 100. Ans. 2.17568.
9. Divide .8727587 by .162. Ans. 5.38739, &c.

REDUCTION OF DECIMALS.

CASE I.

To reduce a vulgar fraction to a decimal.

RULE.—Divide the numertator by the denominator.

EXAMPLES.

1. Reduce $\frac{5}{26}$ to a decimal. Ans. .1923076, &c.
2. Required the decimal expressions for $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$. Ans. .25, .5, and .75.
3. Reduce $\frac{14}{17}$ of $\frac{10}{13}$ to a decimal. Ans. .6045956, &c.
4. Reduce 7*s*. 6*d*. to the decimal of a £. Ans. £.375.
5. Reduce 10*s*. 9¼*d*. to the decimal of a £. Ans. .53854£. &c.
6. Reduce 1pwt. to the decimal of a lb. Troy. Ans. .0041666, &c. lb.
7. Reduce 14 drams to the decimal of a lb. Avoirdupois. Ans. .0546875 lb.
8. Reduce 4cwt. 2qrs. to the decimal of a ton. Ans. .225 ton.
9. Reduce 174 drams to the decimal of an cwt. Ans. .0060686, &c. cwt.
10. Reduce 17yds. 1ft. 6in. to the decimal of a mile. Ans. .00994318, &c.
11. Reduce 3qrs. 2na. to the decimal of a yard. Ans. .875.
12. Reduce 1gal. of wine to the decimal of a hhd. Ans. .015873.
13. Reduce 72 days to the dec. of a year. Ans. .1972602, &c.

CASE II.

To find the value of any given decimal in the known parts of the integer.

RULE.—Multiply it by the common parts of the integer.

This case is proved by case 1.

EXAMPLES.

1. What is the proper quantity of .76*l*. Ans. 15*s*. 2*d* ⅖qr.
2. Find the value of .625 of a shilling. Ans. 7½*d*.
3. Find the value of .6725cwt. Ans. 2qr. 19lb. 5oz.
4. What is the value of .67 of a league? Ans. 2m. 3po. 1yd. 3in. 1b. c.
5. What is the value of .17 tun of wine? Ans. 42gal. 3.36qts.
6. Find the value of .761 days. Ans. 18ho. 15m. 50.4sec.
7. Find the value of .7lb. of silver. Ans. 8oz. 8pwt.
8. What is the value of .3 of a year? Ans. 109da. 12ho.

CASE III.

To find the value of any number of shillings, pence and farthings by inspection.

RULE.—Write half the greatest even number of shillings for the first decimal figure, and let the farthings in the given pence and farthings possess the 2d and 3d places; observing to increase the 2d place by 5, if the shillings be odd, and the 3d place by 1, when the farthings exceed 12, and by 2 when they exceed 37.

1. Find by inspection the decimal expressions of 16*s*. 4½*d*. and 13*s*. 10½*d*. Ans. .819*l*. and .694.

2. Value by inspection the following sums, and find their total viz. 19*s*. 11¼*d*. 6*s*. 2*d*. 12*s*. 8¾*d*. 1*s*. 10¼*d*. ¾*d*. and 1¼*d*. Ans. £.3.043.

THE SINGLE RULE OF THREE DIRECT IN DECIMALS.

EXAMPLES.

1. If 1.4lb. of mace cost 14.5*s*. what cost 75.31lb.? Ans. £ 38 19*s*. 11*d*. 3.52qrs.

2. If 1pint of wine cost 1.2*s*. what cost 12.5 hhds? Ans. £ 378.

3. If 1yd. of cloth cost 12.3*s*. what cost 3 pieces, each 21.5 yards? Ans. £.39 13*s*. 4.2*d*.

4. A man bought 5.8 tuns oil for £.60.4, but by misfortune it leaked out 50.9 gal. I demand how he must sell the rest per gallon to be no loser? Ans. 10.27*d*. per gallon.

5. If 1oz of silver cost 5*s*. 6*d*. what will 1lb. 10oz. 10pwt. 4gr. come to? Ans. £.6 3*s*. 9½*d*.

6. If I buy 14yds. of cloth for £.10 10*s*. how many ells flemish can I buy for £.283 17*s*. 6*d*. at that rate? Ans. 504 ells 2qrs.

7. How many grains of pure silver are there in the federal dollar, which is to contain 416 grains of standard silver; 179 parts in 1664 parts being alloy? Ans. 371.25gr. see the table.

8. If 15 grains of pure silver be equal to 1gr. of pure gold, how many grains of pure gold will the federal dollar be equal to, which is to contain 371¼gr. of pure silver? Ans. 24.75.

FEDERAL MONEY BY DECIMALS.

The pupil, having obtained a competent knowledge of decimals, will readily see that this money is in every respect added, subtracted, multiplied, and divided, the same as decimals.

Any number of dollars, dimes, cents, and mills, is only the expression of so many dollars and decimals of a dollar; a dime being the tenth part of a dollar, a cent the hundredth, and a mill the thousandth part of a dollar—Thus 4D. 6d. are expressed 4.6dol. 15D. 2d. 4c. 15.24dol. 44D. 1d. 7c. 2m. 44.172dol. 6D. 4c. 6.04dol. 100D. 9m. 100.009dol. 45c. .45dol.

ADDITION.

Add 500D. 6D. 4d. 8d. 7c. 2m. 46D. 8c. 1D. 4d. 5m. 98c. 7m. 11D. 4d. and 6½D. together.

Ans. 573.644D. or which is precisely the same, 573D. 6d. 4c. 4m.

SUBTRACTION.

From 798D. take 459D. 3d. 7c. 9m. Ans. 338.621D.

From 98D. 8c. take 9D. 8d. 5m. Ans. 88D. 2d. 7½c.

MULTIPLICATION.

EXAMPLES.

1. What is the value of 34lb of indigo, at 2D. 3d. 2c. 3m per lb? Ans. 78.982D.=78D. 9d. 8c.2m.

2. What is the value of 1cwt. of sugar, at 12½ cts. per lb.? Ans. 14 dol.

NOTE.—In the following examples, when you have pointed off the decimals in the product, agreeably to the rule in multiplication of decimals, all beyond the mills, or third place of decimals, are decimal parts of a mill.

3. Multiply 14D. 4½c. by 6D. 1d. 6c. Ans.86D.5d.1c.7m.$\frac{2}{10}$.

4. Multiply 76D. 45c. by 9D. 4½c. Ans.691D.49c.0m.$\frac{25}{100}$.

DIVISION.

EXAMPLES.

1. Divide 141D.4d. equally among 17 men. Ans.8D.317m.$\frac{6}{10}$.

2. Divide 100D. equally among 33 men. Ans. 3D.3c.$\frac{1}{33}$.

3. If 1cwt. of sugar cost 14D. what is it per lb? Ans. 12½c.

4. If 156lb of tea cost 70D.98c. what is it per lb? Ans. 45½c.

5. How many English guineas worth 4D. 6d. 6c. 9m. must be given for 500D.? Ans.107 Eng.guineas, and 1d. 5c. 8m.

SIMPLE INTEREST BY DECIMALS.

RULE.—Multiply the principal, ratio, and time together, and it will give the interest required.

Ratio is the simple interest of £.1 for 1 year, at the rate per cent. agreed on; thus the ratio,

At	3	per cent.	.03
	3½		.035
	4		.04
	4½		.045
	5		.05
	6		.06

EXAMPLES.

1. What is the interest of £.945 10s. for 3 years, at 5 per cent. per annum? Ans. £.141 16s. 6d.

2. What is the interest of £.796 15s. for 5 years, at 4½ per cent.? Ans. £.179 5s. 4½d.

3. What is the interest of £.880 for 1½ year at 3½ per cent.? Ans. £.38 10s.

4. What will £.508 14s. amount to in 1 year, at 5 per cent? Ans. £.534 2s. 8d. 1.6qrs.

5. What is the interest of £.355 7s. 6d. for 3½ years at 4½ per cent.? Ans. £.55 19s. 5d.

COMPOUND INTEREST BY DECIMALS.

RULE.—Find the amount of £.1 or 1D. for 1 year at the given rate per cent.

2. Involve the amount thus found to such a power as is denoted by the number of years.

3. Multiply this power by the principal, and the product will be the amount required.

4. Subtract the principal from the amount, and the remainder will be the interest.

EXAMPLES.

1. What is the Compound interest of £.500 for 4 years, at 5 per cent? *the amount is involved thus.*

1.05×1.05×1.05×1.05=1.21550625.

Then proceed by the rule. Ans. £.107 15*s*.0¾*d*.

2. What is the amount of £.764 10*s*. for 4 years. at 4 per cent? Ans. £894 7*s*.

3. What is the amount of 30¾dol. for 6 years, 7 months and 15 days, at 6 per cent. per annum compound interest?

Ans. 45D. 2d. 5c. 4m.

But the shortest and easiest method to cast compound interest, is by the following table.

A Table shewing how much L.1 or 1 dol. will amount to in any number of years under 21, at 6 per cent. per annum compound interest.

Years.		Years.	
1	1.06	11	1.8982
2	1 1236	12	2.0121
3	1.191	13	2.1329
4	1.2624	14	2.261
5	1.3382	15	2.3965
6	1.4185	16	2.5403
7	1.5036	17	2.6927
8	1 5938	18	2.8543
9	1.6894	19	3.0256
10	1.7908	20	3.2071

Use of the Table.

Multiply the principal by the number right against, or answering to the number of years in the question, and you have the amount at one operation.

N. B. When the number of years exceed 20, take any two or more numbers, which added together, make the number, and multiply the sums belonging to each number of years, in the table together, and it will give the sum for that number of years.

4. What is the amount of £.136 15*s*. 6*d*. for 20 years at 6 per cent. compound interest? Ans. £.438:651.

5. What is the amount of £.45 11s. for 8 years and 8 months, at 6 per cent. per annum, compound interest?

Ans £. 75 9*s*. 11*d*.

6. What is the amount of 122D. 56c. for 14 years, at 6 per cent. per annum, compound interest? Ans. 277D. 1d. 8m.

TO EXTRACT THE SQUARE ROOT.

RULE 1.—Distinguish the given numbers into periods of two figures each, putting a point over the place of units, another over the place of hundreds, and so on.

2. Find a square number, either equal to, or the next less than the first period, and put the root of it to the right hand of the given number, as in division, and it will be the first figure of the root required.

3. Subtract the assumed square from the first period, and to the remainder bring down the next period for a dividend.

4. Place the double of the root, already found, on the left hand of the dividend for a divisor.

5. Consider what figure must be annexed to the divisor, so that if the result be multiplied by it the product may be equal to, or the next less than the dividend, and it will be the second figure of the root.

6. Subtract the product from the dividend, and to the remainder bring down the next period, for a new dividend.

7. Find a divisor as before, by doubling the figures already in the root, and from these find the next figure of the root, &c. through all the periods to the last.

If there be decimals in the given number it must be pointed both ways from unity, and the root be made to consist of as many whole numbers and decimals, as there are periods belonging to each; and when the figures belonging to the given number are exhausted, the operation may be continued at pleasure by adding cyphers.

METHOD OF PROOF.

Multiply the root by itself, and add the remainder, if there be any, that sum will be equal to the given number, if the work be right.

EXAMPLES.

1. What is the squre root of

```
     5499025(2345 the root.
     4
     ---
  43)149
     129
     ---
 464)2090
     1856
     ----
4685)23425
     23425
     -----
```

2. What is the square root of

```
     184.2000(13.56 the root.
     1
     ---
  23)84
     69
     ---
 265)1520
     1325
     ----
2707)19500
     18949
     -----
       551 remainder
```

3. What is the square root of 106929? Ans. 327
4. What is the square root of 152399025? Ans. 12345
5. What is the square root of 119250669121?
Ans. 345326 &c.
6. What is the square root of 368863?
Ans. 607.34092 &c.
7. What is the square root of 761.801216?
Ans. 27.6007 &c.
8. Suppose 12544 soldiers are to be put into rank and file, in the form of an equal square; how many soldiers will be in front, and how many deep? Ans. 112.

TO EXTRACT THE CUBE ROOT.

Rule 1.—Separate the given number into periods of three figures each by putting a point over every 3d figure from unit's place.

2. Find the greatest cube in the first period, and put its root in the quotient.

3. Subtract the cube thus found from the said period, and to the remainder prefix the next period, and call this the *resolvend.*

4. Under this resolvend write the triple square of the root, so that units in the latter may stand under the place of hundreds in the former, and under the said triple square, write the triple root, removed one place to the right hand, and call the sum of these the *divisor*.

5. See how often the divisor may be had in the resolvend, exclusive of the place of units, and write the result in the quotient.

6. Under the divisor write the product of the triple square of the root by the last quotient figure, setting the unit's place of this line under the place of tens in the divisor; under this line write the product of the triple root by the square of the last quotient figure, so as to be removed one place beyond the right hand figure of the former; and under this line removed one place forward to the right hand, write the cube of the last quotient figure, and call their sum the *subtrahend.*

7. Subtract the subtrahend from the resolvend, and to the remainder bring down the next period for a new resolvend with which proceed as before, and so on till the whole is finished.

Note.—The same rule must be observed for continuing the operation and pointing for decimals as in the square root.

EXAMPLES.

1. What is the cube root of

48228544(364 root : Ans.	Proof.
27	364
	364
21228 resolvend.	
	1456
27 triple square of 3.	2184
09 triple of 3.	1092
279 divisor.	132496
	364
162 triple square of 3, × 6.	
324 triple of 3, × by square o 6	529984
216 cube cf 6.	794976
	397488
19656 subtrahend.	
	48228544 given number.
1572544 second resolvend.	
3888 triple square of 36.	*If at any time there be a remainder, let it be added to the last product.*
108 triple of 36.	
38988 second divisor.	
15552 triple square of 36, × 4.	
1728 triple of 36, × by square of 4.	
64 cube of 4.	
1572544 second subtrahend.	

2. What is the cube root of 389017? Ans. 73.
3. What is the cube root of 1092727? Ans. 103.
4. What is the cube root of 27054036008? Ans. 3002.
5. What is the cube root of 122615327232? Ans. 4968.
6. What is the cube root of 146703.483? Ans. 52.74.
7. Suppose a stone of a cubic form to contain 474552 solid hes, what is the superficial content of one of its sides? Ans. 6084 inches.

POSITION.

Position is a method of performing such questions as cannot be resolved by the common and direct rules, and is of two kinds, called *single and double.*

SINGLE POSITION.

RULE 1.—Take any number and perform the same operation with it, as the question directs, and if the result be either too much or too little, the true number may be found thus:

2. As the result of the operation is to the position, so is the given number to the number required.

EXAMPLES.

1. A, B, & C. determining to buy together a quantity of timber, worth £.36, agree that B shall pay $\frac{1}{3}$ more than A, and C $\frac{1}{4}$ more than B; how much must each man pay?

```
Suppose A paid £.12    As 48 : 12 : : 36
then B must pay  16                12
and C must pay   20                ——
                 ——          48)432(9 A's part,  }
                 48             432 12 B's       } Answer
                                ——  15 C's       }
                                    ——
                                    36 Proof.
```

2. A person having about him a certain number of crowns, said, if the $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ of them were added together, they would make 65 crowns, how many had he? Ans. 60.

3. A certain sum of money is to be divided between 4 persons in such a manner that the first shall have $\frac{1}{3}$ of it; the second $\frac{1}{4}$; the third $\frac{1}{6}$, and the fourth the remainder, which is £.28. What was the sum? Ans. £.112.

4. A person after spending $\frac{1}{3}$ and $\frac{1}{4}$ of his money, had £.60 left. What had he at first? Ans. £.144

5. What number is that which being increased by $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$ of itself, the sum will be 125? Ans. 60.

6. $\frac{7}{8}$ of a certain number exceeds $\frac{4}{5}$ of it by 6; what is the number? Ans. 80.

DOUBLE POSITION.

Double Position teacheth to resolve questions by making two suppositions of false numbers.

RULE 1.—Take any two convenient numbers, and proceed with each according to the condition of the question.

2. Find how much the results are different from the result in the question.

3. Multiply each of the errors by the contrary supposition, and find the sum and difference of the products.

4. If the errors be alike, divide the difference of the products by the difference of the errors, and the quotient will be the answer.

5. If the errors be unlike, divide the sum of the products by the sum of the errors.

NOTE.—The errors are said to be alike, when they are both too great, or both too little; and unlike, when one is too great and the other too little.

EXAMPLES.

1. A, B and C would divide £.100 between them, so as that B may have £.3 more than A, and C £.4 more than B; how much must each have?

	£		£
1. Suppose A had	9	2. Suppose A had	15
then B must have	12	B must have	18
and C	16	and C	22
	37		55

£	£
100	100
37	55
63 first error,	45 second error.

When I supposed A had { £ 9 - - £ 63 ; 15 - - - 45 } was the error.

18 diff. of error.

45	63	
9	15	
405	945	
	405	
Diff. of products	540	

£
18)540(30 A's part.
54 33 B's
— 37 C's } Answer.
0 ——
100 proof.

2. A man lying at the point of death, said he had in a certain coffer £.100 which he bequeathed to three of his friends after this manner;—the first must have a certain sum, the second must have twice as much as the first, wanting £.8 and the third must have three times as much as the first wanting £.15; how much must each man have?

Ans. the first £.20 10s. second £.33 third £.46 10s.

3. A, B and C, built a house which cost £.100, of which A paid a certain sum, B paid £.10 more than A, and C paid as much as A and B; I demand each man's share in that charge? Ans. A £ 20 B £.30 C £.50.

4. Three persons discourse together concerning their ages; says A, I am 20 years of age; says B, I am as old as A, and half C; says C, I am as old as you both; I demand the age of each person? Ans. A 20, B 60, C 80.

5. A man lying at the point of death, left to his thre all his estate in money, viz. to F. half, wanting £.50, one third, and to H. the rest, which was £.10 less th share of G; I demand the sum left, and each man's p

Ans. the sum left £.360 } whereof F had £ G £. H £.

6. A man having drove his swine to market, viz. hog and pigs; received for them all £.50 being paid for eve 18s. for every sow 16s. for every pig 2s.; there were as hogs as sows, and for every sow there were three pig many were there of each sort? Ans. 25 hogs, 25 sows, 7

7. A man is to drive 48 young turkies 40 miles; a every turkey which comes alive to the end of the jour is to have 3*d*.; but for every one which dies by the wa to pay 6*d*.; at the end he received 72*d*.: how many c the way? A

8. A and B purchased 20 acres and 72 rods of land a 57c. per acre. By agreement A was to have 6 acres rods of the land, and B was to have the remainder, and 4D. per acre more than A. How much did each man cost him per acre? Ans. A 22D. 75c. 8m. and B 26D. 7

ARITHMETICAL PROGRESSION.

Any rank of numbers increasing by a common excess creasing by common difference, is said to be in arithmetic gression; such as the numbers 1, 2, 3, 4, 5, &c. and 7, 5

The numbers which form the series are called the

Any three of the five following terms being given, t er two may be readily found.

1. The first term, } commonly called the extremes.
2. The last term, }
3. The number of terms.
4. The common difference.
5. The sum of all the terms.

CASE I.

The first term, the number of terms, and the common diff being given, to find the last time.

Rule.—Multiply the number of terms less 1, by the com mon difference, to that product add the first term, th will be the last term.

EXAMPLES.

1. The first term is 3, number of terms 7, and co difference 5, what is the last term? $6 \times 5 + 3 = 3$

2. A traveller went 6 miles the first day, 9 the second, &c. increasing every day's journey 3 miles, he travelled 61 days; how many miles did he go the last day? Ans. 186.

CASE II.

The first term, the last term, and the number of terms being given, to find the aggregate, or total sum of all the terms.

RULE.—Multiply the sum of the extremes by the number of terms, and half the product will be the answer.

EXAMPLES.

1. The first term is 2, the last term 53, and the number of terms 18, required the sum of the series.

$53+2\times18\div2=495$ the Ans.

2. A traveller went 6 miles the first day, 186 the last day; he travelled 61 days; how many miles did he go in all?

$6+186\times61\div2=5856$ miles, Ans.

To answer the following questions, find the last term by case 1, and the sum of all the terms by case 2.

1. A merchant sold 100 yards of cloth, the first yard for 1s. the second 2s. the third 3s. &c. how much did he receive for the cloth? Ans. £.252 10s.

2. Bought 19 yards of shalloon, at 1*d.* for the first yard, 3*d.* for the second, 5*d.* for the third, &c, increasing 2*d.* every yard; what did I give for the whole? Ans. £.1 10*s.* 1*d.*

3. A mercer sold 20 yards of silk, at 3*d.* the first yard 6*d.* the second, 9*d.* the third, &c. I demand what he sold the 20 yards for? Ans. £.2 12*s.* 6*d.*

4. If 100 stones be placed in a right line, exactly 1 yard asunder, and the first one yard from a basket, what length of ground will the man go who gathers them up singly, returning with them one by one to the basket? Ans. 5 miles 1300 yards.

CASE III.

The first term, the last term, and the number of terms being given, to find the common difference.

RULE.—Divide the difference of the extremes by the number of term less 1, and the quotient will be the common difference.

EXAMPLES.

1. The extremes are 2 and 53, and the number of terms 18, required the common difference? Ans. 3.

2. A man is to travel from Boston to a certain place in 12 days, and to go 3 miles the first day, and increasing every day by an equal excess, so that the last day's journey may be 58 miles; required the daily increase, and the distance of the place from Boston? Ans. daily increase 5m. distance 366m.

CASE IV.

Given the first term, the last term, and the common difference to find the number of terms.

RULE.—Divide the difference of the extremes by the common difference, and the quotient increased by one is the number of terms required.

EXAMPLES.

1. If the extremes be 3 and 19, and the common difference 2 what is the number of terms ? Ans. 9.

3. A man going a journey, travelled the first day 5 miles, the last day 35 miles, and increased his journey every day 3 miles, how many days did he travel ? Ans. 11.

GEOMETRICAL PROGRESSION.

Any series of numbers, the terms of which gradually increase or decrease by constant multiplication, or division, is said to be in geometrical progression ; thus, 4, 8, 16, 32, 64, &c. and 243, 81, 27, 9, 3, 1, &c. are series in geometrical progression, the one increasing by a constant multiplication by 2, and the other decreasing by a constant division by 3.

The number by which the series is constantly increased or diminished, is called the ratio.

CASE I.

Given the first term and the ratio, to find any other term assigned.

RULE.—Set down the first number, and multiply it by the ratio, and that product again by the ratio, and thus go on for 5, 6 or 7 terms, at pleasure : then multiply any of those places by itself, and divide the product by the first number, and it will be the double of that, wanting one place.

EXAMPLES.

1. The first term of a geometrical series is 2, number of term 13, and the ratio 2 ; required the last term.

1, 2, 3, 4, 5, 6, 7,
2, 4, 8, 16, 32, 64, 128, leading term.

Then 128×128=16384, which divided by 2, the first number gives 8192 the answer.

2. Required the 12th term of a geometrical series, whose first term is 3 and ratio 2.—

1, 2, 3, 4, 5, 6,
3, 6, 12, 24, 48, 96,

Then ×96×96=9216÷3=3072=11th term, which,* ×2=6144=12th term the answer.

3. The first term of a geometrial series is 1, the ratio 2, and the number of terms 23, required the last term.

---

*If the ratio had been 3, 4, or 5, &c. you must have multiplied by it.

1, 2, 3, 4, 5, 6.
1, 2, 4, 8, 16, 32. Then 32×32=1024=11th term, which, ×2=2048=12th term, then, 2048×2048=4194304=23 term the answer.

CASE II.

Given the first term, the last term, and the ratio, to find the aggregate or total sum of the series.

RULE.—Multiply the last term by the ratio, and from the product subtract the first term, and the remainder, divided by the ratio less one, will give the sum of the whole series.

EXAMPLES.

1. The first term of a series in geometrical progression is 1, the last term is 2187, and the ratio 3, what is the sum of the series? 2187×3=6561—1=6560÷2=3280 Ans.

2. The extremes of a geometrical progression are 1,&65536, and the ratio 4, what is the sum of the series? Ans. 87381.

To answer the following questions, find the last term by case 1, and the sum of the series by case 2.

1. A merchant sold 15 yds. of satin, the first yard for 1*s.* the second for 2*s.* the third for 4, the fourth for 8*s.* &c. I demand the price of the whole? Ans. £.1638 7*s.*

2. A draper sold 20 yds of cloth, the first yard for 3*d*. the second for 9*d*. the third for 27*d*. &c. in triple proportion geometrical; required the price of the whole? Ans. £.21792402 10*s.*

3. A crafty servant agreed with a farmer (ignorant in numbers) to serve him 12 years, and to have nothing for his service but the produce of a wheat corn for the first year, and that product to be sowed for the second year, and so on from year to year, until the end of the said time—I demand the worth of the whole produce; supposing the increase to be in a tenfold proportion, and sold at 4*s*. per bushel?

Ans. £.45211 4*s*. rejecting remainders.

NOTE. 7680 wheat or barley corns are supposed to make 1 pint.

4. A thresher worked 20 days at a farmer's, and received for the first day's work 4 barley corns, for the second 12, for the third 36, and so on in triple proportion geometrical—I demand what the 20 days labour came to, supposing the whole quantity to be sold for 2*s*. 6*d* per bushel?

Ans. £ 1773 7*s*. 6*d*. rejecting remainders.

5. A cunning jockey had a fine horse, to which a gentleman took a particular fancy, and after many words had passed between them, the jockey agreed to sell him to the gentleman for the price his shoes would come to, at one farthing for the first nail, and to double the price every nail; the number of nails were 32, I demand what the horse came to at that rate? Ans. £.4473924 5*s*. 3¾*d*.

DUODECIMALS.

Duodecimals is a rule made use of by workmen and artificers in casting up the contents of their work; also the superficial content or area of boards, glass or any thing may be found by this rule, when the dimensions are taken in feet, inches and parts.

3 feet, 7 inches, 2 seconds, 3 thirds, 7 fourths, are thus written.

f.	in.	"	'''	''''
3	7	2	3	7

Addition of Duodecimals.

RULE.—12 of the right hand denomination, make one of the left hand, continually.

EXAMPLES.

f.	in.	"	'''
14	4	10	11
11	5	6	10
7	7	10	11

f.	in.	"	'''	''''
7	4	10	11	9
1	5	9	10	8
8	7	10	11	1

Multiplication of Duodecimals.

Commonly called Cross Multiplication.

Note.—Feet multiplied by feet give feet.

Feet	×	by inches give inches.
Feet	×	by seconds give seconds.
Inches	×	by inches give seconds.
Inches	×	by seconds give thirds.
Seconds	×	by seconds give fourths, &c.

	f.	in.	
Mult.	7	3	
by	4	7	
	29	0	"
	4	2	9
	33	2	9

Here I multiply the 7ft. 3in. first by 4ft.—saying 4 times 3 are 12, set down 0 and carry 1; then 4 times 7 are 28 and 1 is 29. Next I multiply the same 7 ft. 3in. by 7 inches, saying 7 times 3 are 21, set down 9 seconds and carry 1 inch, then 7 times 7 are 49 and 1 is 50 inches, or 4 ft. 2in. which set down, then add them together, and the whole is 33 feet, 2 inches, 9 seconds.

	f.	in.	f.	in.	f.	in.	f.	in.	f.	in.
Multiply	7	5	4	6	9	7	8	3	4	7
by	3	9	5	8	9	7	6	4	5	10
Product	27	9 9	25	6	91	10 1	52	3	26	8 10

	f.	in.	f.	in.	f.	in.
Multiply	3	11	6	5	7	10
	9	5	6	6	8	11
Product	36	10 7	41	8 6	69	10 2

	f.	in.	''		f.	in.	''		f.	in.	''
Multiply	7	3	2		8	6	9		3	10	6
by	1	7	3		7	3	8		7	4	8
	7	3	2		62	6	7 9		28	7	7
	4	2	10 2''''								
		1	9 9 6								
Product	48	11	7 9 11 6								

	f.	in.	''
Multiply	5	6	7
by	8	9	10 ''' ''''

MENSURATION OF PLANES AND SOLIDS.*

The several kinds of measuring are three, viz.

1. *Lineal*, by some called running measure, which is taken by a line, and respects length without breadth, the parts of which are, 12 inches 1 foot, 3 feet 1 yard, &c.

2. *Superficial*, or square measure, which respects length and breadth; the parts of which are 144 inches 1 foot, 272¼ feet 1 rod, 9 feet 1 yard.

3. *Solid*, or cube measure, which respects length, breadth and depth, or thickness; the parts are 1728 inches 1 foot, 27 feet 1 yard.

A Decimal Table of Inches.

Inches.	Decimals.		Inches.	Decimals.	
½	.041666	OF A FOOT.	6½	.541666	OF A FOOT.
1	.083333		7	.583333	
1½	.125		7½	.625	
2	.166666		8	.666666	
2½	.208333		8½	.708333	
3	.25		9	.75	
3½	.291666		9½	.791666	
4	.333333		10	.833333	
4½	.375		10½	.875	
5	.416666		11	.916666	
5½	.458333		11½	.958333	
6	.5		12	.1	

* To treat of this doctrine in its full latitude, would swell this work to a size far bigger than was at first designed. What I shall principally aim at will be to lay down a few plain rules in the most necessary part of mensuration of planes and solids by which the pupil may be enabled to solve such easy questions and problems as may occur in the ordinary routine of business.

I Of Planes.

The superficial content or area of of any plane or surface is found four ways, viz. by whole numbers, by decimals, by practice, and by cross multiplication in each of which methods I shall give examples of operation, and one may serve as a proof to the other.

CASE I.

The length and breadth given to find the area.

GENERAL RULE.

Multiply one by the other, and such as the length and breadth are, such is the content; If the length and breadth be feet, the content is feet; if inches then inches, &c.

After having found the content in inches, rods, &c. to bring it into an higher denomination, as feet, acres, &c. make use of a proper divisor.

EXAMPLES.

1. If a board be 12½ feet long, and 15 inches broad how many square feet doth it contain? Ans. 15 feet 7½ inches.

See the work by whole numbers.

```
inches.
*150 long
  15 broad
 ---
  75
 15
 -----
144)2250(15ft. 7½in. Ans.
    144
    ---
     810
     720
     ---
Rem.  90*
Mul.by 12 inc's 1 ft.
     -----
144)1080(7 inches.
    1008
    ----
Rem. 72
Mul. by 4  the quarters in an inch.
    ---
144)288(2 qrs. or ½ of an inch.
    288
```

*If the length be given in feet, and the breadth in inches, multiply one by the other, and divide the product by 12, the quotient is the answer in feet.

*If you divide the remainder by 12 the quotient will be inches and the remainder will be seconds.

Decimally.

12.5
1.25

625
250
125

Ans. Feet. 15.625
12

Inches, 7.500
4

quarters, 2.000

By Practice.

	ft.	in.	
3 in. ¼	12	6''	
	3	1	6
	15	7	6 Answer.

By cross Multiplication.

ft.	in.	
12	6	
1	3	
12	6''	
3	1	6
15	7	6 Ans.

2. Suppose a board be 14ft. long, and 15 inches broad; what is the content in square feet? Ans. 17½ft.

3. A piece of wainscot is 15½ft. long, and 2¼ft. wide; what is the area in feet? Ans. 34ft. 10½ in.

4. If a board be 15 inches wide, 5ft. 1in. long; what is the content in feet? Ans. 6ft. 4¼in.

5. A piece of land is 183 rods wide, and 200 rods long, how many acres does it contain?* Ans. 228 acres, 120 rods.

6. If a board be 10 inches wide, and 20ft. long, how many superficial feet does it contain? Ans. 16ft. 8 inches.

7. Suppose a board is 7½ inches broad, and 29¼ feet long, what is the area in feet? Ans. 18ft. 3in. 4' 6''.

8. What is the content of a board 19½ft. long, and 19¼ inches wide? Ans. 31ft. 3¼ inches.

9. What is the content of a board 17¾ inches wide, and 16½ feet long? Ans. 24ft. 0in. 5'' 3'''.

10. A piece of land is 4¼ rods wide, and 5½ rods long; how many square rods does it contain? Ans. 23.375 rods.

11. How many bricks, 6 inches long, and 3 inches wide, will floor a stable 17ft. long and 9 ft. wide? Ans. 1224.

---

*160 *rods make an acre.*

12. How many oak plank will floor a barn 60½ ft. long, and 33½ft. wide, when the plank are 15 feet long, and 15 inches wide? Ans. 108.

13. A room painted being 45ft. 8in. in compass, and 10ft. 6in. high, what is the content in square yards? Ans. 53yds. 2ft. 6in.

NOTE.—If a board be wider at one end than the other, add the breadth of both ends together, and take one half of the sum for a mean breadth.

14 There is a board 16inc. wide at one end. and 8inc. at the other, and 10ft. long; what is the content in feet? Ans. 10ft.

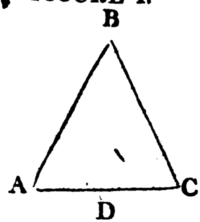
15. Suppose a board 10ft. long, and one end 10inc. wide and the other 2ft. 10inc. wide; what is the content in feet. Ans. 18¼ t.

CASE II.

To measure the gable end of a house, or any triangle.

Let A. B. C. be the gable end of a house roof. whose base A. C. is 24ft. and the perpendicular line B. D. 16ft. how many square feet does it cantain?

FIGURE 1.



RULE.—Multiply the base by the perpendicular—half that product is the answer.

24×16=384÷2=192 Ans.

NOTE.—The perpendicular is always drawn from the opposite angle to the base or longest side.

There is a triangle, or gable end, whose base is 76ft, and perpendicular 31ft. how many feet does it contain? Ans. 1178

A piece of land in form of a gable end, whose base is 49½ rods, and perpendicular 27 rods: how many acres does it contain? Ans. 4 acres, 28¼rods.

CASE III.

The breadth given to find how much in length will make a foot a yard, &c.

RULE.—As the breadth is to a foot, a yard &c. so is a foot a yard, &c, to that length which will make a foot, a yard, &c.

EXAMPLES.

1. If a board be 9 inches broad, what length of it will make a superficial foot? Ans. 16 inches.

2. If a board be 7½ inches broad, how much in length will make a square foot? Ans. 192 inches.

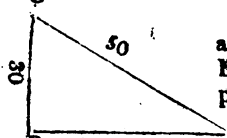
3. A piece of matting is 27 inc. broad, how much in length will make a square yard? Ans. 4 feet.

4. A borrowed of B a board 12½ ft. long, and 13 inc. wide; A is now ready to pay, and has a board 20inc. wide, how much in length of it must B have for his debt? Ans. 7 ft. 11 inc. 55.

CASE IV.

Given any two sides of a right angled triangle to find the third side.

Figure 2.



DEFINITION. ABC (Fig. 2) represent a right angled triangle; right angled at B. the line AB is the base; AC the hypothenuse, and BC the perpendicular.

NOTE.—The longest side of a triangle is usually called the base, except in a right angled triangle, where the longest of the two legs, which include the right angle is called the base.

Given the base 40, and perpendicular 30, to find the hypothenuse.

RULE.—The square root of the sum of the squares of the base and perpendicular is the length of the hypothenuse.

40×40=1600 square of the base.

30×30=900 square of the perpendicular.

then 1600+900=2500, the square root of which is 50; the length of the hypothenuse—See figure 2.

Given the hypothenuse 50, and perpendicular 30, to find the base.

RULE.—The square root of difference of the squares of the hypothenuse and perpendicular is the length of the base.

50×50=2500 square of the hypothenuse.

30×30=900 square of the perpendiclar.

then 2500—900=1600, the square root of which is 40, the length of the base. See the figure.

Given the hypothenuse 50, and base 40, to find the perpendicular.

RULE.—The square root of the difference of the squares of the hypothenuse and base, is the height of the perpendicular.

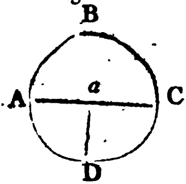
50×50=2500 and 40×40=1600, then 2500—1600 the uare root of which is 30 the height of the perpendicular.

OF A CIRCLE.

CASE V.

DEFINITION. A circle is a perfect round figure contained under one line called the circumference, as ABCD, figure 3.

Figure 3.



The Diameter is that line which divides the circle into two equal parts, or semi-circles, as the line A *a* C. The radius is always the semi-diameter; any right line drawn from the centre, *a*, to the circumference, is the radius; as the line. *a* D, *a* C, or *a* A.

The questions relating to the measuring of a circle and its parts may be solved by the following rules.

1. *Given the diameter to find the circumference.*

RULE.—As 7 is to 22, or as 1 is to 3.14159 so is the diameter to the circumference.

What is the circumference of a circle whose diameter is 12? Ans. 37.71.

2. *Given the circumference to find the diameter.*

RULE.—As 22 is to 7, or 1 to .31831, so is the circumference to the diameter.

What is the diameter of a circle whose circumference is 326. Ans. 103.72.

3. *To find the superficial content, or area of a circle.*

RULE.—Multiply half the diameter by half the circumference, the product will be the area: Or, multiply the square of the diameter by .7854, the product will be the area.

The circumference of a circle is 37.7 and diameter 12, required the area. Ans. 113.1.

The diameter is 11, what is the area? Ans. 95+

The circumference is 34½, required the area? Ans. 94.7439.

4. *Given the area, to find the diameter.*

RULE.—Multiply the square root of the area by 1.12837, the product will be the diameter.

What is the diameter of the circle whose area is 95.0334? Ans. 11—

OF SOLIDS.

CASE I.

Given the length, breadth, and depth; to find the solid content.

GENERAL RULE.

Multiply the depth by the breadth, and that product by the length; and such as the length, breadth, and depth are, such

is the content, viz. if feet, the content will be feet; if inches, then inches, &c.

This multiplication may be performed by whole numbers, by decimals, or by cross multiplication, as will appear by the following examples.

NOTE.—If you multiply the length, depth and breadth together, taken in inches, then 1728 must be the divisor, and the quotient will be the solid or cubic feet, and if any thing remains, it must be divided by 144, and the quotient will be inches, and if any thing still remains divide it by 12, and the quotient will be seconds, and what remains will be thirds.

EXAMPLES.

1. A piece of timber is $16\frac{1}{4}$ feet long, 18 inches deep, and 15 inches broad; how many solid feet does it contain?

By whole numbers.

*195 inches long.
18 deep.
———
1560
195
———
3510
15 inches broad
———
1755
351
———
1728)52650(30 feet.
5184
———
144)810(5 inches.
720
———
12)90(7 seconds.
84
——
6 thirds.

* *When the length is given in feet only, without any inches, you may multiply by the feet in length, and divide by 144, and the quotient will be feet, and the remainder, if there be any, divide by 12, the quotient will be inches, and the remainder will be seconds.*

By Practice.

	ft.	in.	″	‴
6 inc. $\frac{1}{2}$	16	3		
	8	1	6	
3 inc. $\frac{1}{4}$	24	4	6	
	6	1	1	6
	30	5	7	6

By Decimals.

```
         16 25 feet long.
          1  5 feet deep.
        ------
          8125
          1625
        ------
        24.375
          1.25 feet broad.
        ------
        121875
         48750
         2437
        ------
  feet  30.46875
              12
        --------
inches   5.62500
              12
        --------
seconds  7.50000
         12
        ----  ft.  in.  ''  '''
thirds 6.0 ans.30   5    7   6
```

By Cross Multiplication.

```
ft.     in.
16       3  long.
 1       6  deep.
-------------
16       3  ''
 8       1  6
-------------
24       4  6
 1       3  0 broad.
-------------
24       4  6  '''
 6       1  1  6
-------------
30       5  7  6
```

2. A piece of timber is 17 inches square, and 6 feet 5 inches long, required the solid feet. Ans. 12ft. 10in. 6'' 5'''

3. A piece of timber 70 feet long, 16 inches deep, and 13 inches broad how many cubic feet does it contain? Ans. 101 feet, 1 inch, 4 seconds.

4. Suppose a Piece of timber 9 inches broad, 6½ inches deep, and 17 feet 11 inches long, how many solid feet does it contain? Ans. 7ft. 3in 4'' 1''' 6''''

5. How many cubic feet are there in a piece of timber of the following bigness, viz. 19 inches broad, 11 inches deep, and 20 feet long? Ans. 29ft. 0⅓ inches.

6. A stone is 2¾ feet square, and 7½ feet long, how many solid feet does it contain? Ans. 56feet. 8in. 7sec. 6'''

CASE II.

Given the length, breadth and depth, to find the content in superficial feet, or in board measure as it is called by those who buy and sell in this way.

RULE.—Multiply the length by the breadth, and that product by the depth, and divide by 12, the quotient is the answer in feet.

1. How many superficial feet, or feet board measure, are there in a stick of timber 54 feet long, 8 inches board and 7 deep?

54 feet length,
7 inches deep,

378
8 inches broad,

12)3024

252 answer.

RULE 2.—Multiply the length by the number of 12's which may be had in the product of the breadth and depth, and if there be any remainder, after so dividing by 12, take it out of the length by practice.

QUEST.—Required the superficial feet in a stick of timber 15 feet long, 8 inches broad and 9 deep?

By Rule 1.

15
8

120
9

12)1080

90 feet answer.

By Rule 2.

8×9÷12=6 for a multiplier.

15
6

90 answer.

How many superficial feet are there in a frame of the following dimensions, viz. 6 cills 32 feet long, 8 by 8 inches 5 beams 32 feet long, 8 by 8 inches; 3 posts 18 feet long, 8 by 8 inches; 4 posts 17 feet do. 8by 8 in. 12 posts 13 ft.long 8 by 8 inches; 2 king posts 12 ft.8 by 8 in.; 2 plates 42 feet long, 7 by 8 in.; 4 hip spars 23 ft. long, 7 by 8 in. 22 girts 10 ft. long, 6 by 7in. 4 girts 16 ft. long, 6 by 7in. 12 spars 19 ft. long 6 by 7 in. 7 rafters 31 ft. long, 4 by 5 in.; 7 rafters 12 ft. long, 4 by 5 in. 52 sleepers 10 feet long, 5 by 6 inches; 12 sleepers 10 ft. long 5 by 5 inches? Ans. 8153 feet.

*To measure tapering Square Timber.**

RULE.—Take one side of the square in the middle of the stick of timber, and proceed by the foregoing rules, and you will get the true content very nearly.

If a stick of timber, either square, round, or triangular, run in a true taper from the base to a point, find the superficial content at the base, which multiplied by ⅓ of the length, gives the true content.

A stick of timber is 4½ feet square at the base, and 18 ft. long, running to a point; required the cubic feet.

Ans. 12 1½ ft.

* If a stick of timber be girted where it would tip easily, if laid across another stick, its solid content would be more exactly found.

CASE III.

To find the solidity of a round stick of timber, or cylinder.

RULE.—Find the superficial content of one end (by the rules in case 5, in mensuration of planes,) which multiply by the length of the stick, the product will be the solid content.

NOTE.—This rule supposes both ends of a bigness.

A round stick of timber is 18 inches diameter, 20 feet long; how many solid feet does it contain?

*As 7 : 22 :: 18 : 56.57 the circumference.

Then 56.57 ÷ 2 = 28.285 half the circumference, then 28.285 × 9 = 254.565 inches, the superficial content of the base, or one end.—Then 254.565 × 20 = 5091.3 ÷ 144 = 35.3 feet. Ans. very nearly.

Admit a round stick of timber to be 4 feet in circumference, and 34 feet long, required the cubic feet. Ans. 43 ft. 2¼ inc.

CASE IV.

To find how much a round stick of timber will hew, if made square.

RULE.—Take half the diameter of the given stick, and multiply it by itself, viz. square it, and that product multiply by 2, and by the given length which product divide by 144, and the quotient will be the answer in feet.

Suppose a piece of timber 15 feet long, and 20 inc. diameter, of equal bigness from end to end; I desire to know how many cubic feet it will contain, when hewn square? Ans. 20ft 10inc.

CASE V.

To find the solidity of a round stick of timber which is bigger at one end than the other.

RULE.—Multiply together the diameters of each end; multiply also their difference by itself, and add ⅓ of the last product to the first, which sum multiply by the length, and this last product multiply by the number .7854 gives the solidity.

Suppose a tree 40 feet long, the diameter at one end 18 inc. at the other end 2 feet 6 inches; required the cubic feet?

Ans. 128 ¼ft. very nearly.

CASE VI.

Given the breadth and depth in inches to find how much in length will make a solid foot.

RULE.—Multiply one by the other, and let the product be a divisor to 1728, the quotient is the number of inches in length it will take to make a solid foot.

If a piece of timber be 24 inches broad, and 18 inches thick, what length of it will make a solid foot? Ans. 4 inches.

A piece of timber is 8 inches square, what length of it will make a cubic foot? Ans 27 inches.

*The proportion as 7 is to 22 is near enough in most cases.

CASE VII.

The breadth and depth being given to find what length it will require to make any number of solid feet desired.

RULE.—Multiply the proposed number of feet by 144, divide that product by the product of the breadth and depth, the quotient will be feet—if any thing remain multiply it by 12 and take the former divisor, the quotient will be inches.

If a stick of timber be 10 inches broad, and 14 inches deep, what length will it require to make $6\frac{1}{4}$ solid or cubic feet?

Ans. 6ft. 5in. $\frac{4}{7}$.

NOTE.—After you have prepared the numbers for division, as the rule directs, if the dividend be less than the divisor, it must undergo the same operation as if it were a remainder; the quotient will be the inches in length it will require to make a solid foot.

If a stick of timber be 24 inches square, how much in length will it take to make 2 solid feet? Ans. 6 inches.

Observations on the customary way of measuring round timber shewing it to be very erroneous.

It has long been the custom (and by some thought to be an infallible rule) to take the circumference, or girth of a tree, or stick of timber, in the middle with a small cord or string; then double this string into four parts, and that length is called equal to the side of the square which the tree would hew to; which square is multiplied by itself in inches and that product by the length, in feet; and this last product divided by 144, gives the solid or cubic feet. But this rule is very erroneous, and does injustice to the buyer, which I will endeavor to demonstrate by a very simple method, thus: Suppose you take the circumference, or girth of a tree, and find it to be $75\frac{1}{2}$ inches, one quarter of which is $18\frac{9}{10}$ inches, nearly, which by the customary way, is said to be equal to one side of the square which the tree, would hew to. Now describe a circle, whose circumference shall be equal to the circumference, or girth of the tree, and see how large a square can be formed in this circle.

If the circumference be $75\frac{1}{2}$, then the diameter will be 24 very nearly; therefore describe a circle of 24 inches diameter, and the side of the largest square, which can be formed in such a circle is 17 in. which shews that the buyer of such a stick of timber by the customary way, would pay for almost 19in. square, and when he comes to hew it, would have but 17in. square, which in a stick of 20ft long, would make 10 cubic feet difference.

The most exact way to measure such timber is by case 3 in solids, and if a tree be long and tapering, you may take several lengths and girths, and find the diameters by the circumferences or girths.

An Example wrought both ways.

A piece of round timber 30 in. girth, and 24 ft. long; I demand how many cubic feet it will contain when hewn square?

1. By case 3 in solids.

22 : 7 :: 30 in. cir.
7
22)210(9.54 in. diam.
198
120
110
100
88
12

2)9.54
4.77 half the diam.
4.77
3339
3339
1908
22.7529
2
45.5058 area of the square.
24 feet the length.
1820232
910116
144)1092.1392(7 ft. 7inc. Ans.
1008
12)84
7 inches.

By the customary way.

4)30 inches girth.
7½
7 5 quarter girth.
7.5
375
525
56.25
24 feet in length.
22500
11250
184)1350.00(9 ft. 4½ inches,*
1296
12)54(4 inches
48
6''

**If there be any who suppose that by this method they get the solid content of the stick, are in a greater error still, tho' on the other hand; for the solid feet in this stick are 11.9 almost 12 feet as will appear by the foregoing rules.*

A brief Recitation of some of the foregoing Rules and Observations respecting Round Timber.

To find the cubic or solid feet in a round piece of timber; work by case 3, in solids.

To find how many solid feet it will contain when hewn square, by case 4.

To find what the side of a square would be, (when hewn square) describe the circle; as per observations:—

Or, find the superficial content of the square by case 3, aforesaid, the square root of which will be one side of the square sought.

How many inches square will the abovementioned tree hew to? It appears by the work that the area of the square is 45¼ inches, nearly; the square root of which is 6¾, very nearly, which is the square desired.

TO MEASURE WOOD.

Although wood is measured by the foregoing rules, yet it may be necessary to mention something of the method, and how the rules may be applied.

A pile of wood that is 4 feet high, 4 feet broad, and 8 feet long, is called a cord; equal to 128 solid feet, which are divided into 8 equal parts, called feet. By this division 16 solid or cubic feet are called one foot of wood.

EXAMPLES.

1. Admit a load of wood 12½ feet long, 3¼ feet wide, and 4½ feet high; how many feet doth it contain?

By whole numbers.

```
   in.
   150 long,
    39 wide,
   ----
   1350
    45
   ----
   5850
    54 high,
   ----
   2340
  2925
  -----
1728)315900(182 feet
     1728
     ----
     14610
     13824
     -----
       4860
       3456
       ----
   144)1404(9 in.
       1296
       ----
     12)108
       ----
         9 sec.
```

Ans. 11 6/16 feet of wood.

By practice.

```
in.  |     | ft.  in.
 3   |  ¼  | 12    6
     |     |       3
     |     | --------
     |     | 37    6   ''
     |     |  3    1   6
in.  |     | ----------
 6   |  ½  | 40    7   6
     |     |           4
     |     | ----------
     |     | 162   6   0
     |     |  20   3   9
     |     | ----------
     |     | 182   9   9  Ans.
```

By Decimals.

```
12.5 feet long,
3.25 wide.
-----
  625
 250
375
------
40.625
    45 high.
-------
203125
162500
--------
182.8125 cubic feet.
```

By cross multiplication.

ft.	in.		
12	6		long.
3	3		wide.
37	6		
3	1	6	
40	7	6	
4	6		high.
162	6	0	
20	3	9	
182	9	9	

How much will this load of wood come to at 12s. per cord?

ft. s. ft.

128 : 12 :: 182¾ : 17s. 1d. Ans.

2. A pile of wood is 6 ft. long 3 ft. wide, and 8 feet deep; how many feet of wood doth it contain? Ans. $3\frac{6}{16}$ft. of wood.

3. Suppose a load of wood, 8½ft. long, 6ft. wide and 5 ft. high, how many cords of wood does it contain?

Ans. 255 cubic ft.=1 cord, $7\frac{15}{16}$ft. wood, almost 2 cords.

4. If a sled load of wood be 12½ft. long, 4ft high, and 2½ wide; how many cord feet does it contain? Ans. 7 very nearly.

5. In a load of wood 4½ft. high, 3½ft. wide, and 9¾ long, how many feet of wood?

Ans. 153½ cubic ft.=$9\frac{9}{16}$ ft. wood =1 cord 1½ feet nearly.

NOTE.—When the inches are no aliquot part of a foot, the answer may be found by cross multiplication easier than any other rule. Those who are unacquainted with decimals and cross multiplication may multiply the width and heighth together, taken in inches, and that product by the length in feet, and this product divided by 144 gives the solid feet. But if there be inches with the length, and you multiply by the length in inches, then 1728 must be the divisor, as in the first example.

6. How many feet of wood are there in a load 12ft. long 4ft, 5in. high, 3ft. 7inches wide—and how much will it come to at 14s. 6d. per cord?

Ans. almost 12ft =to 1½ cord, and it comes to 21s. 6d.

7. What must I give for a load of wood 8ft. long. 3ft high and 2ft. 5inch. wide, at 12s. per cord? Ans. 5s. 5¼d.

When the base or bottom of a wood pile is given to know how high to build to contain any number of feet desired.

RULE.—As the base multiplied by itself in inches, is to 1, so is 1728 increased as many times as you want your wood pile to contain cubic feet, to the inches in height you must build to contain the number of cubic feet desired.

EXAMPLES.

1. How high must I build to contain 64 cubic feet, which is $\frac{1}{2}$ a cord, when my base is 4 feet square?

$48 \times 48 = 2304$.

Then $1728 \times 64 = 110592$.

Then, as 2304 is to 1, so is 110592 to 48in. = 4ft. Ans.

2. How high must a wood pile be raised to contain 152 cubic feet, or $9\frac{1}{2}$ cord feet, when the base is $7\frac{1}{2}$ft. one way, and 6ft. 8inc. the other? Ans. $36\frac{1}{2}$ inches very nearly.

Questions to Exercise Mensuration.

1. A house $49\frac{1}{2}$ feet long, and 33 feet wide, how many *rods* of land does it cover?

$49.5 \times 33 = 1633.5$ square feet.

$16.5 \times 16.5 = 272.25$ the square feet in a rod square.

Then $1633.5 \div 272.25 = 6$ square rods, Ans.

2. How many rods square are there in 640 acres of land viz., how long must one side of the square be to contain said land, and how many men can stand thereon supposing each man to occupy 18 inches square?

Ans. 320 rods square, and 12390400 men can stand thereon.

3. A lent B a piece of cedar board 6 feet square and has received two pieces each 3 feet square; who is the person indebted, and how much? Ans. B owes A 18 feet.

4. The wall of a town is 17ft. high, which is surrounded by a ditch of 20 feet in breadth; I demand the length of a ladder that shall reach from the outside of the ditch to the top of the wall? Ans. 26.2 feet nearly.

5. How many feet of boards will it take to cover a barn which is 76 ft. long, 32ft. wide 14ft. post, and 20ft. spar; and how many shingles will it require to lay the roof, admitting 6 shingles to lay a superficial foot?

Ans. 6600ft. boards and 19152 shingles.

NOTE.—The roof boards are allowed to be 21 ft. long.

6. I desire to know the circumference and diameter of a circle which shall contain one acre of land; also the side of a square whose superficial content shall be equal thereto?

Ans. 14.27 rods diameter, 44.84 rods circumference, and 12.64911 rods = 12 rods, 10ft. $8\frac{1}{2}$inc. side of the square.

7. A had a load of wood 12ft. long, 4ft 6in. high and 3ft. 8in. wide, for which B gave him a log of wood 24ft. long, 88in. girth or circumference; what is the balance at 15s. per cord.

Ans. 8s 6d 1qr $\frac{12873}{18432}$.

8. If a stick of timber be $17\frac{3}{4}$ feet long 12 inches broad and 9 inches thick; and $3\frac{1}{2}$ solid feet be sawed off one end, how long will the stick then be? Ans. 13ft 1 inch.

9. Admit the measure which is called a half-bushel be 14 in. diameter, 7 inches deep, how many cubic inches will it contain? Ans. 1078.

You will seldom find two half-bushels measure within 4 or 5 cubic inches of each other, even when they are made by the same workman, and sealed with the same seal.

The bushel measures now in use will hold about 2150½ cubic inches, that generally agreeing with the ~~half-bushels~~ now used among us. I ~~shall therefore~~ agree to call a bushel dry measure ~~2150½~~ solid or cubic inches.

10. How many bushels will a chest contain, being 6 feet long 4ft. high, and 2ft. wide? Ans. 38½ rejecting remainders.

11. I would have a box made exactly square that will hold 1 bushel, how many inches square must it be made?

Ans. 12.91 inches very nearly.

12. How high must a chest be made to contain 7 bushels, when the length is 4ft, and the width 1½ft. Ans. 17$\frac{4}{10}$ inch.

13. I want a tub made, of equal bigness from top to bottom, that will hold 10½ bushels, the diameter of which is limited to 28 inches, how high must it be made? Ans. 36.65+ inch.

Concerning the Guaging of Vessels.

I am not greatly acquainted with the method which practical guagers use to ascertain the content of various kinds of casks.—From my own experience, by actual trial and the application of rules to prove it, I find it attended with uncertainty. The precise bigness of the inside of a cask cannot often be found, by reason of the heads and staves being uneven; some staves are much thicker in the same cask than others, which is frequently the case with the heads. Furthermore, one head will sometimes be a little bigger than the other, and it seldom happens that the diameter of a head will measure alike in all places. In fact, the inside of most casks are very irregular figures, and a gallon is soon lost or gained by these little irregularities.

A gallon, wine measure, it said to contain 231 cubic inches; but I have found them to differ nearly half a pint from one another; therefore great care must be taken, in measuring casks by actual trial, that the measure is exact, which is made use of

CASE I.

To measure a mash-tub, churn, or any vessel which forms a figure like the frustum of a cone.

RULE.—Make use of case 5, in solids, to find the cubic

inches in the vessel, which divide by 231 to get the wine gallons, and by 282 for the beer or ale gallons.

N. B. *Wine, brandy, rum, perry, vinegar, cider, gin, oil, and molasses are measured by wine measure.*

1. My gallon measure is 6 $\frac{6}{10}$ inches diameter at the bottom, 4 $\frac{3}{10}$ inches at the top, and 10 $\frac{1}{10}$ inches high, how many solid inches does it contain? Ans. 231=1 gal. wine measure.

2. A mash tub or churn, being 1 foot 7 $\frac{75}{100}$ inches high the bottom diameter 11 $\frac{6}{10}$ inches, and the top diameter 7 $\frac{45}{100}$ inches, how many wine gallons will it hold? Ans. 6 gals. 1$\frac{1}{2}$ pint.

NOTE.—If the staves of a cask are straight from the head to the centre of the bung-hole, which is the shape of some of our cider-barrels and smaller casks, it may be measured by the above rule. I have proved it by actual measure.

3. How many gallons, wine measure, will a cask hold that is 1 foot 4 $\frac{3}{10}$ inches head diameter, 1 foot 7 $\frac{3}{10}$ inches bung diameter, and 2 feet 1 $\frac{4}{10}$ inches long? Ans. 28 $\frac{1}{10}$ galls.

CASE II.

To measure a cask when the staves are curving between the head and the bung.

RULE 1.—Multiply the difference between the head and bung diameters by ,8 if the staves are very curving, or by ,7 ,6 ,5 or ,4 as the staves may be less curving, and add it to the the less diameter, then square that sum and note the product.

2. If the content be required in wine gallons, multiply the products by ,0034 or by ,0027 for beer or ale, which last product multiply by the length of the cask, and it gives the number of gallons.

EXAMPLE.

A cask is 2 feet 11 $\frac{4}{10}$ inches long, 2 feet 8 inches bung diameter, and 2 feet 3$\frac{1}{2}$ inches head diameter. How many gallons will it contain, wine measure? Ans. 113 galls.

MISCELLANEOUS QUESTIONS.

1. A man being asked how many sheep he had in his drove said, if he had as many more, half as many more, and 7 sheep and an half, I should have 20; how many had he? Ans. 5.

2. A water-tub holds 147 gallons; the pipe usually brings in 14 gallons in 9 minutes; the tap discharges, at a medium, 40 gallons in 31 minutes; now, supposing these both to be carelessly left open, and the water to be turned on at 2 o'clock in the morning; a servant at 5, finding the water running, shuts the tap, and is solicitous to know in what time the tub will be filled after this accident, in case the water continues to flow from

the main. Ans. the tub will be full at 3m.$48\frac{14}{217}$ sec. after 6.

3. If $\frac{1}{3}$ of 6 be three, what will $\frac{1}{4}$ of 20 be? Ans. $7\frac{1}{2}$.

4. A Factor bought a certain quantity of broadcloth and drugget, which together cost him £.81. The quantity of broadcloth that he bought was 50 yards, at 18*s*. per yard, and for every 5 yards of broadcloth he had 9 yards of drugget; I demand how many yards of drugget he had, and how much the drugget cost him per yard?

Ans. 90 yards drugget, at 8*s*. per yard.

5. Six rogues, viz. A, B, C, D, E and F, having entered into a confederacy, do agree to divide whatever sums of money they shall at any time take upon the highways, according to their valour, that is, in proportion to the number of scars they should then have on their faces. The first two, viz. A and B being very bold and daring fellows, had received A 20, and B 19 scars; the next two, viz. C and D, having a less share of courage, and not caring to stand all brunts, had each of them but 9 scars; but the other two, viz. E and F, being mere cowards, always turned their backs at the least opposition, and so by chance they had one a piece: And they having at several times, stolen the sum of £.700 13*s*. I desire to know how they must divide it?

Answer	A must have	£.237	10*s*.	2*d*.	$0\frac{8}{59}$.
	B ——— ———	£.225	12*s*.	7*d*.	$3\frac{43}{59}$.
	C ——— ———	£.106	17*s*.	6	$3\frac{39}{59}$.
	D ——— ———	£.106	17*s*.	6*d*	$3\frac{39}{59}$.
	E ——— ———	£. 11	17*s*.	6*d*.	$0\frac{21}{59}$.
	F ——— ———	£. 11	17*s*.	6*d*.	$0\frac{24}{59}$.

5. If one pound and ten, and 40 groats,
Will buy a load of hay;
How many pounds with 19 crowns
For 20 loads will pay? Ans. £.38 11*s*. 8*d*.

6. A gentleman a chaise did buy,
A horse and harness too;
They cost the sum of threescore pounds,
Upon my word 'tis true;
The harness came to half the horse,
The horse twice of the chaise,
And if you find the price of them,
Take them and go your ways.

Ans. Chaise £.15 Horse £.30 Harness £.15.

TABLES.

Constructed on 100 dollars, for 30 years, at 6 per cent per ann. Compound Interest. The first column expresses the years the others express dollars, cents and mills.

	TAB. I. Shewing the amount of 100 dollars from 1 year to 30.			TAB. II. Shewing the present worth of 100 D. due at the end of any number of years from 1 to 30.			TAB. III. Shewing the amount of 100 D. annuity for any number of years from 1 to 30.			TAB. IV. Shewing the present worth of 100 D. annuity for any number of years from 1 to 30.			TAB. V. The annuity which 100 D. will purchase for any num. of years from 1 to 30		
Ys	D	C	M	D	C.	M	D.	C.	M.	D.	C.	M	D.	C.	M.
1	106	00	0	94	34	0	100	00	0	94	34	0	106	00	0
2	112	36		89	0		206			183	34		54	54	3
3	119	10	2	83	96	2	318	36		267	30	2	37	41	1
4	126	24	8	79	20	9	437	46	2	346	51	1	28	85	9
5	133	82	3	74	72	5	563	71		421	23	6	23	74	
6	141	85	2	70	49	5	697	53	3	491	73	1	20	33	6
7	150	36	3	66	50	5	839	38	5	558	23	6	17	91	4
8	159	38	5	62	74	1	989	74	8	620	97	7	16	10	4
9	168	94	8	59	18	9	1149	13	3	680	16	6	14	70	2
10	179	08	5	55	83	9	1318	08		736	00	5	13	58	7
11	189	83		52	67	8	1497	16	4	788	68	3	12	67	9
12	201	22		49	69	6	1686	99	6	838	[illegible]	9	11	92	8
13	213	29	3	46	88	3	1888	21	6	885	26	2	11	29	6
14	226	09		44	22	9	2101	50	9	929	49	1	10	75	8
15	239	65	5	41	72	6	2327	59	9	971	21	7	10	29	6
16	254	03	4	39	36	4	2567	25	4	1010	58	1	9	89	5
17	269	27	6	37	13	6	2821	28	8	1047	71	7	9	54	5
18	285	43	3	35	03	4	090	56	4	1082	74	1	9	23	6
19	302	55	8	33	05	1	3375	99	7	1115	79	2	8	96	2
20	320	71	1	31	18		3678	55	5	1146	97	2	8	71	9
21	339	95	4	29	41	5	3999	26	6	1176	38	7	8	50	1
22	360	35	1	27	75		4339	22		1204	13	7	8	30	5
23	381	97	2	26	17	9	4699	57	1	1230	31	6	8	12	8
24	404	89		24	69	7	5081	54	3	1255	01	3	7	96	8
25	429	18	3	23	29	9	5486	43	3	1278	31	2	7	82	3
26	454	93	4	21	98		5915	61	8	1300	29	2	7	69	
27	482	23		20	73	6	6370	55		1321	02	8	7	57	
28	511	16	4	19	56	2	6852	78		1340	59		7	45	9
29	541	83	4	18	45	5	7363	94	4	1359	04	5	7	35	8
30	574	84	4	17	41		7905	77	8	1376	45	5	7	26	5

Application of Table I.

When the principal, rate and time are given to find either the amount or the interest.

1st. What will 156D. 38c. amount to in 8 years at 6 per cent. per annum compound interest ?

Against 8 years, 159D. 38c. 5m. Then say.

c. m. c.

As 10000 : 159385 : : 15638 to the answer.

15638

1375080
478155
956310
796925
159385

1|0000)249246|2630

249, 2 4 6 Ans.

D. d. c. m.

NOTE 1.—Subtract the principal from the amount, the remainder is the compound interest.

2d.—Required the compound interest of 325 3-4D. for 30 years.

Ans. 1545D. 17c. 5m.

NOTE 2d.—When the number of years exceed 30—

RULE—Take from the column of years two such numbers as will, being added together, make the number of years sought for—Then take the two sums standing against those two numbers of years in Table I. and multiply them together (expressed in mills) and from the product strike off five figures to the right hand ; the figures on the left will be the amount of 100D. for the number of years sought, in mills.

3. Required the amount of 333D. 33c. 3m. for 46 years—

Against 30 years, 574D. 34c. 4m. and against 16 years, 254D. 3c. 4m.

Then 574344m. × 254034m. = 1459029|03696 : Then say.

m. m. m. D. d. c. m.

As 100000 : 1459029 : : 333333 : 4683, 4 2 5 Ans.

Application of Table II.

When the amount, rate and time are given, to find the principal.

1. What is the present worth of 2524D. 97c. due 4 years hence, discounting at the rate of 6 per cent. per annum, compound interest ?

Against 4 years in Table 2, is 79D. 20c. 9m. Then say,

D. c. D. d. c. m. D. c.

As 100 00 : 79, 2 0 9 : : 2524 97 : 2000 dolls. Ans.

2. What principal must be put to interest 30 years at 6 per cent. per ann. compound interest to amount to five and three fourths dollars ?

Ans. 1D. 1m.

N. B. If the number of years exceed 30, work by Note 2, in Table I, observing to take the numbers from Table II.

3. Received 20D. in full for the amount of a note of hand which was given to me 40 years ago at 6 per cent. per annum, compound interest. What is the principal ?

Ans. 1D. 94c. 4m.

Application of Table III.

An annuity is a sum of money payable every year for a certain number of years, or forever.

When the debtor keeps the annuity in his own hands beyond the time of payment, it is said to be in Arrears.

The sum of all the annuities for the time they have been forborn, together with the interest due upon each, is called the amount.

If an annuity is to be bought or sold, the price which ought to be given for it, is called the present worth.

1. If 30 dollars yearly rent or annuity be forborn 5 years, what will it amount to at 6 per cent. per annum, compound interest?

563D. 71c. against 5 years—Then say,

D. c. D. D. c.

As 100 : 56371 : : 30 : 169, 11 Ans.

2. A man had an estate which would rent for 48 dolls. per ann. Upon his decease he left it to his son, being then 7 years old. He is now 21 years old, and has received nothing from his guardian for the rent of the estate. How much is due at the rate of 6 per cent, per annum compound interest? Ans. 1008D. 72c. 4m.

To find the amount of 100D. *annuity for a term of years exceeding* 30.

RULE—Find what principal will produce as interest in one year the sum of 100D. Then by Table I, agreeably to note 2, see what that principal will be augmented to at the term of time proposed; and that augmented sum, after deducting the said principal, will be the answer. An example at large will better explain this rule.

Suppose the Tables did not exceed 10 years, and it was required to find the answer to the last question, viz. the amount of 48 Dols. annuity for 14 years.

D. int. D. prin. D. int. D. d. c. m.

As 6 : 100 : : 100 : 1666 6 6 6 principal.

Then against 10 years in Table 1, is 179085 mills.

against 4 years, - - - is 126248

226,091,23080 Amount of 100D. for 14 years.

D. c. m. (See Table 1.)

D. mills. mills.

Then, As 100 : 226091 : : 1666666 : 3768181,82606 augmented sum;

from which take 1666666 principal.

2101,515, amount of 100D. annuity forborn 14 years (see Table III, against 14 years) which is to be used the same as in the example, viz.

D. m. D. D. c. m.

As 100 : 2101515 : : 48 : 1008, 72 7 Ans.

D. int. D. prin. D. int. D.

Or thus, As 6 : 100 : : 48 : 800 principal.

D. mills. D. D. c. m.

Then, As 100 : 226091 : : 800 : 1808,728 from which

take 800,

1008,728 Answer.

3. A boy had a salary of 1D. per annum, settled upon him to hold from his birth to his death—but it being so small, he did not call for it until he was 80 years old. How much was then due, reckoning compound interest at 6 per cent? Ans. 1746D. 55c.

Application of Table IV.

What ready money will purchase an annuity of 30 dollars, to continue 5 years at 6 per cent. per annum, compound interest?

Against 5 years in the table, is 421 D. 23 c. 6 m. Then say,

	D.		D. c. m.		D.		D. c. m.	
As	100	:	421,23 6.	::	30	:	126,37 8	Answer.

Application of Table V.

What annuity to continue 5 years at 6 per cent. per annum, compound interest, will 126D. 37c. 8m. purchase?

Against 5 years in the Table, is 23D. 74c. Then say,

	D.		D. c.		D. c. m.		D.	
As	100	:	23,74	::	126,37 8	:	30	Answer.

BY an Act of Congress, passed February 9th, 1793, all foreign gold and silver coins shall pass current as money within the United States, and be a legal tender for the payment of all debts and demands, at the several and respective rates following, viz: The gold coins of Great Britain and Portugal of the present standard, at the rate of 100 cents for every 27 grains of the actual weight thereof;—the gold coins of France, Spain, and the dominions of Spain, of their present standard, at the rate of 100 cents for every 27 grains 2 fifths of the actual weight thereof;—Spanish milled dollars, weighing 17 pwts. 7 grains equal to 100 cents; and in proportion for the parts of a dollar;—Crowns of France weighing 18 pwts. 17 grains, equal to 110 cents, and in proportion for the parts of a crown.

N. B. English and Portuguese gold coins consist of English Guineas, Johannes, Moidores and their parts.

French and Spanish gold coins consist of French Guineas, Four Pistole pieces and their parts.

EXAMPLES.

1. What is an English Guinea worth which weighs 5 pwts. 6 grains?

	gr.		c.		pwt.	gr.		D.	d.	c.		s.
As	27	:	100	::	5	6	: the answer, which is	4	6	$6\frac{2}{3}$	=	28.

2. What is the value of a French guinea, weighing 5 pwts. 6 grains?

	gr.		c.		pwt.	gr.		D.	d.	c.	m.		s.	d.
As	27 4	:	100	::	5	6	: the answer,	4	5	9	8	=	27	7

3. What is the value of a Johannes, weighing 18 pwts.?

Ans. 16 D.

NOTE.—After you have weighed the piece of money, cast your eye into the following tables once or twice, and you will get its value without many figures.

A TABLE,

For receiving and paying the gold coins of France, Spain, and the dominions of Spain, of their present standard, agreeable to an Act of Congress, passed Feb. 9th, 1793.

gr.	c.	m.	gr.	c.	m.	pwt.	D.	c.	m.	pwt.	D.	c.	m.
1	3	6½	13	47	5	1	0	87	6	13	11	38	7
2	7	3	14	51	1	2	1	75	2	14	12	26	3
3	11	0	15	54	7	3	2	62	7	15	13	13	9
4	14	6	16	58	4	4	3	53	3	16	14	1	5
5	18	2	17	62	0	5	4	38	0	17	14	89	0
6	21	9	18	65	7	6	5	25	5	18	15	76	6
7	25	5	19	69	3	7	6	13	1	19	16	64	2
8	29	2	20	73	0	8	7	00	7	oz.			
9	32	8	21	76	6	9	7	38	3	1	17	51	8
10	36	5	22	80	3	10	8	76	0	2	35	3	6
11	40	1	23	84	0	11	9	63	5	3	52	55	5
12	43	8				12	10	51	1				

A TABLE,

For receiving and paying the gold coins of Great-Britain and Portugal, of their present standard agreeably to an act of Congress, passed February 9, 1793.

gr.	c.	m.	gr.	c.	m.	pwt.	D.	c.	m.	pwt.	D.	c.	m.
1	3	7	13	48	1	1	0	88	8	13	11	55	5
2	7	4	14	51	8	2	1	77	7	14	12	44	4
3	11	1	15	55	5	3	2	66	6	15	13	33	3
4	14	8	16	59	2	4	3	55	5	16	14	22	2
5	18	5	17	62	9	5	4	44	4	17	15	11	1
6	22	2	18	66	6	6	5	33	3	18	16	00	0
7	25	9	19	70	3	7	6	22	2	19	16	88	8
8	29	6	20	74	0	8	7	11	1	oz.			
9	33	3	21	77	7	9	8	0	0	1	17	77	7
10	37	0	22	81	4	10	8	88	8	2	35	55	5
11	40	7	23	85	1	11	9	77	7	3	53	33	3
12	44	4				12	10	66	6				

USEFUL FORMS.

Warrantee Deeds.

KNOW all men by these presents, that I, A. B, of Stratham, in the county of Rockingham and state of New-Hampshire, Gentleman, for and in consideration of the sum of one thousand dollars, to me in hand before the delivery hereof well and truly paid by C. D. of said Stratham, yeoman, the receipt whereof I do hereby acknowledge, have given, granted, bargained, sold, and by these presents, do give, grant, bar-

gain, sell, alien, enfeoff, convey and confirm unto the said C D, and unto his heirs and assigns forever.

(*Here insert the premises.*)

To have and to hold the said granted premises, with all the privileges and appurtenances to the same belonging, to him the said C D, his heirs and assigns, to his and their only proper use and benefit forever. And I the said A B, for myself, my heirs, executors and administrators, do hereby covenant, grant and agree to and with the said C D, his heirs and assigns, that until the delivery hereof I am the lawful owner of the said premises, and that I am seized and possessed thereof in my own right in fee simple, and have full power and lawful authority to grant and convey the same in manner aforesaid; that the said premises are free and clear of all and every incumbrance whatsoever, and that I and my heirs, executors and administrators, shall and will warrant the same to him and to his heirs and assigns, against the lawful claims and demands of any person or persons whatsoever.*

In witness whereof, I have hereunto set my hand and seal, this 1st day of November, A. D. 1802. A B. L. S.

Signed, sealed and delivered in presence of

Mortgage Deed.

A mortgage deed is made by inserting the following words or condition of the bargain between the parties, at the close of a warrantee deed. "Provided nevertheless, that if I the said A B, my heirs executor or administrators shall well and truly pay, or cause to be paid, to the said C. D. his heirs, executors, administrators or assigns, the full and just sum of——, on or before the——with lawful interest for the same until paid, then this deed, [as also a certain bond, (or note, as the case may be) bearing even date with these presents, given by me to the said C D. conditioned to pay the sum and interest at the time aforesaid,] shall be void: otherwise shall remain in full force and virtue." In witness whereof, &c.

Quitclaim Deed.

KNOW all men by these presents, that I, A B, of &c. in consideration of the sum of——to me paid by C D. of &c. the receipt whereof I do hereby acknowledge, have remised, released, and forever quitclaimed, and by these presents, remise, release, and forever quitclaim unto the said C D, his heirs and assigns forever.

[*Here insert the premises.*

To have and to hold the same, together with all the privileges and appurtenances thereunto belonging to him the said C D, his heirs and assigns forever. In witness, &c.

Deed given by an Executor or Administrator.

KNOW all men by these presents, that I, A B, of S. in the county of R. and state of N. H. Executor of the last will and testament (or Administrator upon the estate, as the case may be) of C D, late of said

* *If the person who gives the Deed has a wife, and she agrees to sign with her husband, the following words must be inserted in this place. "Likewise I, E. B, wife of the said A B, do hereby surrender up to said C D, all my right of dower, or power of third of, in, and unto the above described premises." In witness whereof, we, &c.*

S. deceased, duly authorized and licensed by the Judge of Probate for said county, to sell so much of the real estate of said deceased as will satisfy the just debts which he owed at the time of his death. In consideration of three hundred dollars paid me by E F of S. gentleman, Have given, granted, bargained, sold, and by these presents do give, grant, bargain, sell and convey to said E F, his heirs and assigns forever, all the right, title, estate and demand, which said C D, at the time of his decease, had of, in, and unto [*Here insert the premises.*] He, the said E F, being the highest bidder for the premises at public vendue, duly notified and holden at the late mansion house of said deceased, on the 23d day of April last. To have and to hold the premises, with all the privileges and appurtenances to the same belonging, to him the said E F, his heirs and assigns, to his and their only use and benefit forever.

In testimony, &c.

Lease from One to One.

This indenture of lease, made this—— by and between A B, of—— on one part, and C D of—— on the other part, Witnesseth, that said A B for the consideration hereafter mentioned, has demised, granted, and to farm letten, and does hereby demise, grant, and to farm let, unto said C D, his heirs, executors, administrators and assigns, [*Here describe the premises*] with all the privileges and appurtenances thereunto belonging. To have and to hold the said demised premises, with their appurtenances, for and during the term of——years from this date. And said C D, for himself, his heirs, executors and administrators, does covenant, and agree to pay [Here insert the particulars of the agreement on the part of the lessee] And the parties aforesaid, for themselves respectively, each with the other and their respective heirs, executors and administrators, do further covenant and agree as follows, viz. that said A B, &c. and that, C D, shall, &c. (as their agreement may be.)

In testimony of which, we have hereunto set our hands and seals, &c.

Articles of Agreement.

ARTICLES of agreement made and concluded upon, this—— by and between A B of—— on one part, and E F of—— on the other part, Witnesseth, That said A B, for the consideration hereafter mentioned, has agreed and does hereby covenant and agree, that [Here insert what AB is to do on his part.] And said E. F. on his part does hereby covenant and agree that [Here insert what E F is to do.] To the true and faithful performance of the several covenants and agreements aforesaid the parties aforesaid do hereby respectively bind themselves and their respective heirs, executors and administrators, each to the other, his executors, and administrators, in the penal sum of—— dollars.

In testimony whereof they have hereunto interchangeably* set their hands and seals the day and year above written, A B (L. S.)

Signed, sealed and delivered in E F (L. S.)

presence of

*When the word "interchangeably," is inserted, there should be two draughts, one for each party.

Bond.

KNOW all men by these presents that I, AB, of S. in the county of R. and State of N. H. Blacksmith, am held and firmly bound to CD of said S. Cordwainer, in the sum sf one hundred dollars to be paid to CD or his certain Attorney, his executors, administrators, or assigns, to which payment, well and truly to be made, I bind myself, my heirs, executors and administrators firmly by these presents; Sealed with my seal; dated the 13th day of October 1802.

The condition of this obligation is such, that if the above bounden A.B. his heirs executors or administrators shall [*Here insert the condition of the bond*] then this Obligation to be void, otherwise to remain in force. Signed, &c. A. B. [L. S.]

Letter of Attorney.

KNOW all men by these presents, that I, AB. of —— do authorize and appoint CD of —— my true and lawful Attorney for me and in my name and for my use and benefit to ask, demand sue for, recover and receive of E. F. of —— all sums of money debts and demands whatever, which are due unto me from said EF. and to do all other lawful acts and things whatever concerning the premises, as fully as I might or could do, were I personally present; ratifying, confirming and allowing whatsoever my said Attorney shall in my name, lawfully do, or cause to be done in and about the premises, by virtue of this authority. In witness whereof, &c. A. B. [L. S.]

An acquittance given by the heirs of an estate to the heir on whom the estate is settled.

Received of my Brother A. B. of ——, on whom the estate of my father C.B. late of S. deceased, was settled by a decree of the Judge of Probate for said county, bearing date August ——, one hundred dollars, being the sum said A. B. by said decree was ordered to pay each of his co-heirs. In consideration of which, I hereby release said A. B. from all demands I have against him on account of said decree. Witness my hand. G. B.

An acquittance to an administrator on the payment of a debt due from the Intestate.

Received this 24th day of Oct. A. D. 1802, of A. B. Administrator of the estate of C. D, late of —— deceased, sixty dollars in full of a debt which said C. D. owed me in his life time. I say received by me, E. F.

An acquittance for a Legacy.

Received of A. B. this 24th day of October, A. D. 1802, Executor of the last Will and Testament of of C. D. late of S deceased, —— dollars in full of a legacy bequeathed to me by said C. D. in his last Will and Testament. I say received by me, E. F.

An acquittance for a debt received by a third hand.

Received of A. B. ten dollars by the hand of C. D. in full for goods bought by said A. B. of me. I say received by me, E. F.

Stratham, Nov. 1st, 1802.